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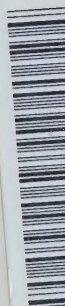
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ATMOSPHERIC MONITORING for TRANSPORTATION EMERGENCIES

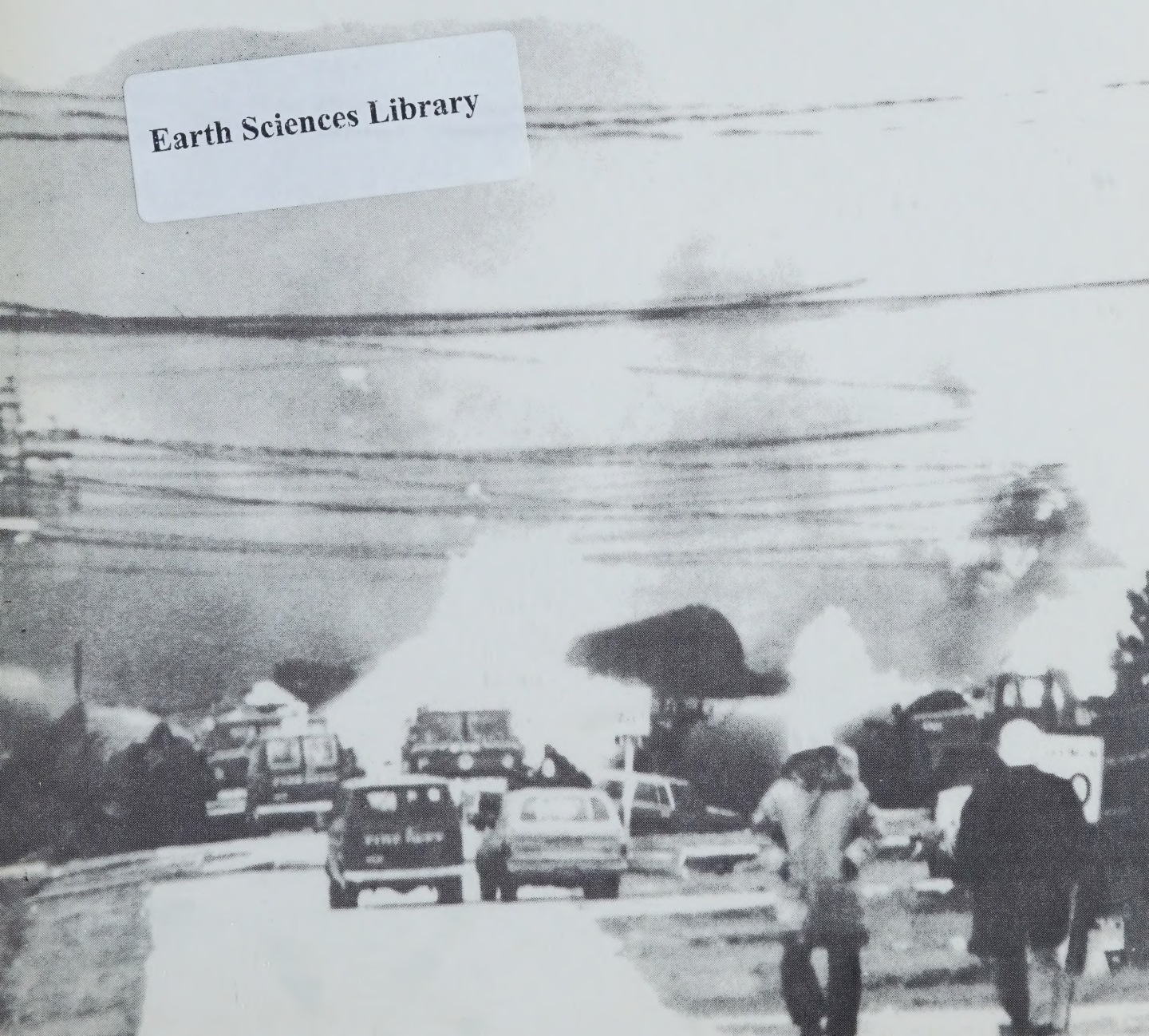
Volume 2:

**Toxic substance monitoring
and safety handbook**

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ISBN 0-7743-6782-2

ATMOSPHERIC MONITORING
FOR TRANSPORTATION EMERGENCIES
VOLUME II



TOXIC SUBSTANCES MONITORING
AND SAFETY HANDBOOK

A Report Prepared for the
Ontario Ministry of the Environment

MOE Report ARB-031-81

By

M.M. Dillon Limited
Consulting Engineers and Planners

&
CONCORD SCIENTIFIC CORPORATION
Environmental & Occupational
Hygiene Consultants

AUGUST, 1981

TABLE OF CONTENTS

DISCLAIMER

This report was prepared by consultants under contract to the Air Resources Branch, Ontario Ministry of the Environment. The views and findings expressed herein and the quality and accuracy of the text are the sole responsibilities of the contractor. Opinions and recommendations expressed are those of the contractor and should not be construed to represent policy of the Ministry of the Environment or the Government of Ontario. Mention of specific brand or trade names does not constitute an endorsement by the Government of Ontario.

1. INTRODUCTION	
1.1 BACKGROUND	1
1.2 PROJECT OBJECTIVES	2
1.3 SCOPE OF STUDY	3
1.4 STUDY AREA	4
1.5 STUDY PERIOD	5
1.6 STUDY LIMITATIONS	6
1.7 STUDY RESULTS	7
1.8 STUDY CONCLUSIONS	8
2. DATA SOURCES	10
3. INDEX OF SYNONYMS	12
4. CHEMICAL DATA SHEETS	13
5. OTHER INFORMATION SOURCES	14
6. EXPOSURE PROTECTION	15
6.1 EXPOSURE EQUIPMENT	15
6.2 AIR CONTACT	16
6.3 AIR PROTECTION	17
6.4 DUSTING	18

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
2. EXPLANATION OF ENTRIES	5
2.1 GENERAL	5
2.2 OBSERVABLE CHARACTERISTICS	5
2.3 SYNONYMS	6
2.4 LABELS	6
2.5 HEALTH HAZARD	7
2.6 FIRE HAZARDS	8
2.7 REACTIVITY	8
2.8 MONITORING METHODS	8
2.9 SAFETY MEASURES	9
2.10 FIRST AID	10
2.11 PHYSICAL PROPERTIES	10
2.12 MANUFACTURERS	10
2.13 NOTES	11
3. DATA SOURCES	12
4. INDEX OF SYNONYMS	14
5. CHEMICAL DATA SHEETS	22
6. OTHER INFORMATION SOURCES	180
7. EXPOSURE PROTECTION	181
7.1 BREATHING EQUIPMENT	181
7.2 SKIN CONTACT	184
7.3 EYE PROTECTION	185
7.4 INGESTION	186

TABLE OF CONTENTS

(continued)

	Page
8. COMPLICATING CONDITIONS AT A SPILL SITE	187
8.1 GENERAL	187
8.2 WEATHER	187
8.3 FIRE	188
8.4 WRECKAGE LITTER	189
8.5 MISCELLANEOUS	189
9. FIRST AID	190
9.1 GENERAL	190
9.2 HEAVY BLEEDING	190
9.3 BREATHING STOPPED	191
9.4 ARTIFICIAL RESPIRATION	193
9.5 SHOCK	197
9.6 POISONING	198
9.7 EYES	200
9.8 BURNS	201
9.9 ENVIRONMENTAL TEMPERATURE EXTREMES	203
9.10 MOVING THE INJURED	206

1. INTRODUCTION

DATA REVISIONS

Identification of Change	Date Issued	Date Inserted	Put into Book By
Volume 1 Development of a Priority Chemicals List			
Volume 2 Toxic Substances Monitoring and Safety Handbook			
Volume 3 Related Monitoring Methods			
The handbook contains a summarized description of appropriate monitoring methods for 79 priority chemicals listed in Table 1. The monitoring methods, along with supporting safety information are presented alphabetically for each chemical. Ministry of the Environment staff, involved in monitoring activities, should refer to this handbook for pertinent monitoring methods, safety precautions, protective equipment and first-aid measures before approaching a spill area. If the nature of the spill is serious, the spill should be approached as that of a highly toxic substance and full-protection gear employed. The handbook is divided into two parts. Part A deals with chemical-specific information and includes the following information: - Section 1 - Explanation of Entries - Section 2 - Data Sources - Section 3 - Index of Sources - Section 4 - Chemical Data Sheets Part B contains supporting information which may be of general interest to chemical emergency response activities: - Section 5 - Other Information Sources - Section 6 - Exposure Protocols - Section 7 - Monitoring Conditions at a Spill Site - Section 8 - Part A			

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1. INTRODUCTION

This handbook is designed for use by Ministry of the Environment field crews in the atmospheric monitoring of chemicals released in transportation-related emergencies. It comprises Volume 2 of a three volume set:

Volume 1	Development of a Priority Chemicals List
Volume 2	Toxic Substance Monitoring and Safety Handbook
Volume 3	Detailed Monitoring Methods

The handbook contains a summarized description of appropriate monitoring methods for 79 priority chemicals listed in Table 1. The monitoring methods, along with supporting safety information are presented alphabetically for each chemical. *Ministry of the Environment field crews, involved in monitoring activities, should refer to this handbook for pertinent monitoring methods, safety precautions, protective equipment and first-aid measures before approaching a spill area. If the nature of the spill is unknown, the spill should be approached as that of a highly toxic substance and full-protection gear employed.*

The handbook is divided into two parts. Part A deals with chemical-specific information and contains the following information:

- . Section 2 - Explanation of Entries
- . Section 3 - Data Sources
- . Section 4 - Index of Synonyms
- . Section 5 - Chemical Data Sheets

Part B includes supporting information, which may be of general assistance in chemical emergency response activity:

- . Section 6 - Other Information Sources
- . Section 7 - Exposure Protection
- . Section 8 - Complicating Conditions at a Spill Site
- . Section 9 - First Aid

TABLE 1
LIST OF PRIORITY CHEMICALS

<u>Toxicity- Quantity Group</u>	<u>Chemical</u>	<u>Toxic Products</u>
(II B)	Acetic acid	
(II B)	Acetic anhydride	
(I C)	Acetonitrile	Cyanides
(I C)	Acrylamide	
(I B)	Acrylonitrile	Cyanides
(II B)	Aluminum chloride	Hydrogen chloride
(II A)	Ammonia-anhydrous	
(II A)	Ammonium hydroxide	
(II C)	n-Amyl alcohol	
(II C)	Aniline	
(II A)	Benzene	
(I C)	Bromine	
(I B)	n-Butyl acrylate	
(II A)	Calcium oxide	
(I B)	Caprolactam	
(II A)	Carbon disulphide	
(II B)	Carbon tetrachloride	
(I A)	Chlorine	
(II B)	Chloroform	
(I C)	Chlorosulphonic acid	Sulphur oxides
(II C)	Cresols	
(I C)	Cyclohexylamine	
(II C)	1,4-Dichlorobenzene	
(III A)	Dichloromethane	
(II C)	2,4-D	
(II A)	Diisobutylene	
(I C)	Diphenylamine	
(I C)	Diphenyl methane 4,4-diisocyanate	

TABLE 1
LIST OF PRIORITY CHEMICALS
 (continued)

<u>Toxicity- Quantity Group</u>	<u>Chemical</u>	<u>Toxic Products</u>
(I C)	Epichlorohydrin	Carbonyl chloride
(III A)	Ethylbenzene	
(I B)	(Ethyl chloride)	Carbonyl chloride
(II B)	Ethylene dibromide	
(I A)	Ethylene dichloride	Carbonyl chloride, hydrogen chloride
(II A)	Ethylene oxide	
(II A)	Formaldehyde	
(II C)	Formic acid	
(II C)	Furfuryl alcohol	
(II C)	Hexamethylenediamine	
(II A)	Hydrochloric acid	
(I B)	Hydrofluoric acid	
(II A)	Hydrogen chloride (anhydrous)	
(I B)	Hydrogen fluoride	
(II C)	Hydrogen peroxide	
(II D)	Hydrogen sulphide	
(I B)	Maleic anhydride	
(II C)	Methyl acrylate	
(I C)	Methylamine	Nitrogen oxides
(I C)	Methyl chloride	
(I C)	Monoethanolamine	
(I C)	(Morpholine)	Nitrogen oxides
(III A)	Naphtha	
(II C)	Naphthalene	
(II A)	Nitric acid	
(II C)	Oxalic acid	
(II C)	Paraformaldehyde	

TABLE 1
LIST OF PRIORITY CHEMICALS
 (continued)

<u>Toxicity- Quantity Group</u>	<u>Chemical</u>	<u>Toxic Products</u>
(I C)	Pentachlorophenol	
(II B)	Perchloroethylene	
(II A)	Phenol	
(I A)	Phosphoric acid	
(I A)	Phosphorus	Phosphorus oxides
(II D)	Polychlorinated biphenyls (PCB)	
(III A)	n-Propyl alcohol	
(III A)	Propylene oxide	
(I B)	Sodium cyanide	
(III A)	Styrene	
(II A)	Sulphur dioxide	
(I C)	Sulphur monochloride	Hydrogen chloride
(II A)	Sulphuric acid	
(I B)	Tetraethyl lead	
(I C)	Tetramethyl lead	
(I C)	Titanium tetrachloride	Hydrogen chloride
(III A)	Toluene	
(I B)	Toluene 2,4-diisocyanate	
(II B)	1,1,1-Trichloroethane	
(II B)	Trichloroethylene	
(I C)	Vanadium pentoxide	
(I B)	Vinyl acetate	
(I A)	Vinyl chloride	Carbonyl chloride, hydrochloric acid, carbon monoxide
(III A)	Xylene	

2. EXPLANATION OF ENTRIES

2.1 GENERAL

This section explains the basis for the entries in the chemical data sheets in Section 5.

Throughout the handbook, the entries have been designed to be as straightforward as possible. Physical and chemical data are presented with their units in all cases and abbreviations are used only where they are considered self-explanatory.

In some instances, the terms "not pertinent" or "not available" have been used. "Not pertinent" indicates that the data item either has no real meaning (e.g. the flash point of a non-flammable chemical) or is not required for assessing a hazardous situation. When data is listed as "not available", this means that it could not be found in any of the sources searched.

The data sheets are arranged in alphabetical order by chemical name. The name used for each chemical is generally that used in the Federal Transportation of Dangerous Goods Code. In the few cases where the chemical is not listed in the Transportation of Dangerous Goods Code, the chemical name considered to be in most common usage has been adopted.

2.2 OBSERVABLE CHARACTERISTICS

Beneath the chemical name is a brief description of the observable characteristics of each chemical, including its physical state (as shipped), colour and odour. When a chemical may be shipped in more than one state, the different states are given.

2.3 SYNONYMS

Alternative systematic chemical names and commonly used trivial names are given. Commercial or trade names are shown in a few cases where they are in common use. An index of synonyms is included as Section 4.

2.4 LABELS

Labels or placards required under the Federal Transportation of Dangerous Goods Act are shown, including the danger class specified therein. The following nine classes (subdivided into divisions) of dangerous goods are designated in the Transportation of Dangerous Goods Code:

- . Class 1 Explosives
- . Class 2 Compressed or refrigerated gases
- . Class 3 Flammable and combustible liquids
- . Class 4 Flammable solids
- . Class 5 Oxidizers and peroxides
- . Class 6 Poisonous and infectious substances
- . Class 7 Radioactive and prescribed substances
- . Class 8 Corrosives
- . Class 9 Miscellaneous

Where a chemical is not listed, its labelling requirements have been determined by application of the criteria for unlisted substances included in the Code. In certain cases, the properties of a chemical are such that two danger classes are specified in the Code. In these cases, the Code requires that both labels or placards be carried, with the label prescribed for the primary risk on the left hand side of that prescribed for the subsidiary risk; and that the subsidiary risk label not show the class or division. These requirements are reflected in the way in which the labels are presented on the chemical data sheets.

In addition to the above, the Transportation of Dangerous Goods Code also requires that the U.N. serial number of the chemical be displayed, either in the lower half of the required placard or separately in black letters on a rectangular orange background. On each chemical data sheet, the serial number is shown adopting the latter approach of black lettering on an orange background. Where two U.N. serial numbers apply because of differences in strength of a chemical solution, both numbers are shown. Where there is no U.N. serial number listed, the entry is shown as N/A (not applicable).

2.5 HEALTH HAZARD

The following types of information on potential health hazards to response personnel are provided:

- a capsule statement as to the primary health effects associated with the chemical
- the toxicity group (I, II or III) defined in Volume 1 of the report - the order of severity increases from III to I
- the IDLH (Immediately dangerous to life and health) and TLV (Threshold limit value)
- more detailed statements as to the health effects resulting from exposure to the vapour or liquid
- odour threshold

Note that the odour threshold should not be relied upon to prevent over-exposure as human sensitivity to odours varies over a wide range and some chemicals cannot be smelled at toxic concentrations. Also, odours can be masked by other odours and some compounds rapidly deaden the sense of smell.

2.6 FIRE HAZARDS

The fire hazard entries describe the flammability or combustibility of the chemical and any special hazards posed by its combustion or behaviour in a fire, including toxic products or potential for explosion. If there is no entry identifying any special hazards it is thought that the combustion products are similar to those formed by the burning of oil, gasoline or alcohol. These products include carbon monoxide (poisonous), carbon dioxide and water vapour.

Note that the specific combustion products are not always known over the range of conditions existing in a fire and some may be hazardous.

2.7 REACTIVITY

The following types of information on the chemical reactivity of each chemical are provided:

- reactivity with water including mixing, floating or sinking characteristics
- reactivity with air
- reactivity with common construction materials and fuels
- potential for polymerization or decomposition

2.8 MONITORING METHODS

For most of the chemicals, a number of options for monitoring are presented and referenced to a more detailed description of the method in Volume 3. The monitoring methods have been selected to meet four basic criteria:

- the capability to provide fast results
- the appropriate sensitivity for a spill situation, i.e. capable of detecting levels hazardous to human health and also, wherever possible, levels at or below environmental standards
- simplicity and ease of use in the field
- low cost

The use of these criteria results in a progression of choices. In general, the first choice is the use of a colorimetric detector tube, if available.

The second option is to use methods developed by the National Institute for Occupational Safety and Health (NIOSH), since these are tested, proven and have the appropriate sensitivity.

A third choice is the TAGA 3000 (Trace Atmospheric Gas Analyzer), which has potentially high sensitivity for a wide range of compounds and offers the possibility of "real-time" monitoring.

In parallel with these considerations, two other alternatives are addressed. Wherever there is an existing method developed by the Ministry of the Environment, this is preferred to the NIOSH method. Also, where commercially available, "real-time" monitoring methods exist, e.g. the use of flame photometers, pulse fluorescence or colourimetric devices for sulphur dioxide, these are presented as a first choice.

2.9 SAFETY MEASURES

Protective clothing requirements and special precautions to be taken at a spill site are described for each chemical. A general discussion on methods for exposure protection is presented in Section 7.

2.10 FIRST AID

First aid information provided throughout the handbook is not intended to replace the need for professional, medical expertise in what may very often be complex situations. Rather, it is intended that the handbook will offer suggestions for immediate first aid in the event of an injury or acute exposure of field personnel to a toxic substance.

2.11 PHYSICAL PROPERTIES

Data are presented on the following physical properties using the abbreviated forms and units shown below:

-	Specific gravity	-	S.G. -	no units ($^{\circ}\text{C}$) ¹
-	Boiling point	-	B.P. -	$^{\circ}\text{C}$ ²
-	Vapour pressure	-	V.P. -	mm Hg ³
-	Vapour density	-	V.D. -	no units
-	Flash point	-	F.Pt.-	$^{\circ}\text{C}$ (CC or OC) ⁴
-	Solubility	-	Sol. -	g/100 ml

2.12 MANUFACTURERS

Selected manufacturers are included as a potential source of assistance in providing specialized knowledge of a particular chemical. If the chemical is manufactured in Ontario, the names, locations and telephone numbers of the Ontario manufacturers are given. If there is no Ontario

-
1. *Temperature of measurement of S.G. given in parentheses.*
 2. *At one atmosphere unless otherwise specified.*
 3. *At 20 $^{\circ}\text{C}$ unless otherwise specified.*
 4. *Closed or open cup method of measurement in parentheses.*

manufacturer, then the Ontario distributors are cited; and in the absence of an Ontario distributor, selected Canadian or U.S. manufacturers. For manufacturers or distributors in Ontario, their locations are given as the town or city - only for manufacturers or distributors outside Ontario is the province or state cited.

2.13 NOTES

A blank section has been included in each data sheet for addition of notes to supplement the existing information.



3. DATA SOURCES

The principal data sources used in compiling this handbook are listed below. In some cases, these sources have been supplemented by information supplied by chemical manufacturers.

We believe that the information supplied for each chemical accurately reflects the data from these recognized sources. In the few instances where conflicts have arisen between data from different sources, professional judgement has been used to resolve these conflicts. No liability, however, is accepted for errors or omissions in such data.

A) MONITORING METHODS

1. Ontario Ministry of the Environment, Air Monitoring Methods
2. Environmental Protection Service, Standard Reference Methods Series
3. NIOSH Manual of Analytical Methods, Volumes 1 to 6
4. Analytical Chemistry
5. Environmental Science and Technology
6. Analyst
7. Journal of Chromatography
8. Dionex Corporation: Ion Chromatography Systems
9. Geophysical Research
10. Atmospheric Environment

B) HEALTH AND SAFETY INFORMATION

11. U.S. Coast Guard: Chemical Hazards Response Information System (CHRIS). Manual II. Hazardous Chemical Data. Washington, D.C. October 1978.
12. Transport Canada: Transport of Dangerous Goods Code. TP1050, Draft III. October 1979.
13. Environment Canada: Emergency Response Manual (Draft). January 1981.
14. General Electric Company, Material Safety Data Sheets 1980.

15. U.S. Environmental Protection Agency: Hazardous Material Spill Monitoring Safety Handbook and Chemical Hazard Guide. January 1979.
16. Transport Canada: Emergency Response Guide for Dangerous Goods. Copp, Clark, Pitman, 1979.
17. U.S. Department of Transportation: Hazardous Materials Emergency Response Guidebook, 1980.
18. Hawley, G.G.: The Condensed Chemical Dictionary. Ninth Edition. Van Nostrand Reinhold, 1977.
19. Verschueren, K.: Handbook of Environmental Data on Organic Chemicals. Van Nostrand Reinhold, 1977.

C) MANUFACTURERS

20. Department of Industry, Trade and Commerce, Chemicals Branch: Canadian Chemical Register. Ottawa, 1978.
21. Corpus Information Services: CPI Product Profiles, 1978-80.

The U.S. Environmental Protection Agency's Spill Monitoring Safety Handbook (ref. 15) is acknowledged as an essentially verbatim source for Sections 7, 8 and 9.



4. INDEX OF SYNONYMS

<u>SYNONYM</u>	<u>COMPOUND NAME</u>
ACETIC ACID	ACETIC ACID
ACETIC ANHYDRIDE	ACETIC ANHYDRIDE
ACETIC OXIDE	ACETIC ANHYDRIDE
ACETONITRILE	ACETONITRILE
ACRYLAMIDE	ACRYLAMIDE
ACRYLIC ACID, BUTYL ESTER	N-BUTYL ACRYLATE
ACRYLIC AMIDE 50 PER CENT	ACRYLAMIDE
ACRYLONITRILE	ACRYLONITRILE
ALBONE	HYDROGEN PEROXIDE
ALUMINUM CHLORIDE	ALUMINUM CHLORIDE
AMINO BENZENE	ANILINE
AMINOCAPROIC LACTAM	CAPROLACTAM
AMINOCYCLOHEXANE	CYCLOHEXYAMINE
2-AMINOETHANOL	MONOETHANOLAMINE
BETA-AMINOETHYL ALCOHOL	MONOETHANOLAMINE
AMINOMETHANE	METHYLAMINE
AMMONIA ANHYDROUS	AMMONIA ANHYDROUS
AMMONIA WATER	AMMONIA HYDROXIDE
AMMONIUM HYDROXIDE	AMMONIUM HYDROXIDE
N-AMYL ALCOHOL	N-AMYL ALCOHOL
1-AMYL ALCOHOL	N-AMYL ALCOHOL
ANHYDROUS ALUMINUM CHLORIDE	ALUMINUM CHLORIDE
ANILINE	ANILINE
ANILINE OIL	ANILINE
ANILINO BENZENE	DIPHENYLAMINE
AQUA FORTIS	NITRIC ACID
AQUEOUS AMMONIA	AMMONIUM HYDROXIDE
AROCLOR	POLYCHLORINATED BIPHENYL (PCB)
ASKAREL	POLYCHLORINATED BIPHENYL (PCB)
AZOTIC ACID	NITRIC ACID
BATTERY ACID	SULPHURIC ACID

<u>SYNONYM</u>	<u>COMPOUND NAME</u>
BENZENE	BENZENE
BENZOL	BENZENE
BENZOLE	BENZENE
BLUE OIL	ANILINE
BROMINE	BROMINE
BUTYL ACRYLATE	N-BUTYL ACRYLATE
N-BUTYL ACRYLATE	N-BUTYL ACRYLATE
N-BUTYLCARBINOL	N-AMYL ALCOHOL
N-BUTYL 2-PROPENOATE	N-BUTYL ACRYLATE
CALCIUM OXIDE	CALCIUM OXIDE
CALX	CALCIUM OXIDE
CAPROLACTAM	CAPROLACTAM
CARBOLIC ACID	PHENOL
CARBON BISULFIDE	CARBON DISULFIDE
CARBON DISULFIDE	CARBON DISULFIDE
CARBON TET	CARBON TETRACHLORIDE
CARBON TETRACHLORIDE	CARBON TETRACHLORIDE
CHLORINATED BIPHENYL	POLYCHLORINATED BIPHENYL (PCB)
CHLORINE	CHLORINE
1-CHLORO-2,3-EPOXYPROPANE	EPICHLOROHYDRIN
CHLOROETHANE	ETHYL CHLORIDE
CHLOROETHENE	VINYL CHLORIDE
CHLOROETHYLENE	VINYL CHLORIDE
CHLOROFORM	CHLOROFORM
CHLOROMETHANE	METHYL CHLORIDE
GAMMA-CHLOROPROPYLENE OXIDE	EPICHLOROHYDRIN
CHLOROSULPHONIC ACID	CHLOROSULPHONIC ACID
CHLORSULPHONIC ACID	CHLOROSULPHONIC ACID
CRESOLS	CRESOLS
CRESYLIC ACIDS	CRESOLS
CYANOGRAN	SODIUM CYANIDE
CYANOETHYLENE	ACRYLONITRILE
CYANOMETHANE	ACETONITRILE

SYNONYM

CYCLOHEXYLAMINE
2,4-D
1,6-DIAMINOHEXANE
1,2-DIBROMOETHANE
DICHLORIDE
1,4-DICHLOROBENZENE
P-DICHLOROBENZENE
1,2-DICHLOROETHANE
DICHLOROMETHANE
2,4-DICHLOROPHENOXYACETIC ACID
DIETHYLENEIMIDE OXIDE
DIISOBUTYLENE
DIPHENYLAMINE
DIPHENYLMETHANEDIISOCYANATE (MDI)
DIPHENYLMETHANE-4,4-DIISOCYANATE
DOWICIDE
EB
EDB
EDC
ELEMENTAL PHOSPHORUS
EPICHLOROHYDRIN
1,2-EPOXYETHANE
1,2-EPOXYPROPANE
ETHANEDIOIC ACID
ETHANENITRILE
ETHANOIC ACID
ETHANOIC ANHYDRIDE
ETHANOLAMINE
ETHER HYDROCHLORIC
ETHYLBENZENE
ETHYLBENZOL
ETHYLCARBINOL
ETHYL CHLORIDE

COMPOUND NAME

CYCLOHEXYLAMINE
2,4-DICHLOROPHENOXYACETIC ACID
HEXAMETHYLENEDIAMINE
ETHYLENE DIBROMIDE
1,4-DICHLOROBENZENE
1,4-DICHLOROBENZENE
1,4-DICHLOROBENZENE
ETHYLENE DICHLORIDE
DICHLOROMETHANE
DICHLOROPHENOXYACETIC ACID
MORPHOLINE
DIISOBUTYLENE
DIPHENYLAMINE
DIPHENYLMETHANEDIISOCYANATE (MDI)
DIPHENYLMETHANEDIISOCYANATE (MDI)
PENTACHLOROPHENOL
ETHYLBENZENE
ETHYLENE DIBROMIDE
ETHYLENE DICHLORIDE
PHOSPHORUS
EPICHLOROHYDRIN
ETHYLENE OXIDE
PROPYLENE OXIDE
OXALIC ACID
ACETONITRILE
ACETIC ACID
ACETIC ANHYDRIDE
MONOETHANOLAMINE
ETHYL CHLORIDE
ETHYLBENZENE
ETHYLBENZENE
N-PROPYL ALCOHOL
ETHYL CHLORIDE

SYNONYM

ETHYLENE BROMIDE
ETHYLENE CHLORIDE
ETHYLENE DIBROMIDE
ETHYLENE DICHLORIDE
ETHYLENE OXIDE
ETHYLENE TETRACHLORIDE
ETHYLENE TRICHLORIDE
FERTILIZER ACID
FLUORHYDRIC ACID
FORMALDEHYDE
FORMALDEHYDE POLYMER
FORMALIN
FORMALITH
FORMIC ACID
FORMIC ALDEHYDE
FORMYLIC ACID
2-FURANCARBINOL
2,5-FURANEDIONE
FURFURALCOHOL
FURFURYL ALCOHOL
2-FURYL-METHANOL
FYDE
GLACIAL ACETIC ACID
HEXAHYDROANILINE
HEXAMETHYLENEDIAMINE
1,6-HEXANEDIAMINE
HYDROCHLORIC ACID
HYDROCHLORIC ACID, ANHYDROUS
HYDROCYANIC ACID, SODIUM SALT
HYDROFLUORIC ACID
HYDROFLUORIC ACID, ANHYDROUS
HYDROFLUORIC ACID, AQUEOUS
HYDROGEN CHLORIDE, ANHYDROUS
HYDROGEN DIOXIDE

COMPOUND NAME

ETHYLENE DIBROMIDE
ETHYLENE DICHLORIDE
ETHYLENE DIBROMIDE
ETHYLENE DICHLORIDE
ETHYLENE OXIDE
PERCHLOROETHYLENE
TRICHLOROETHYLENE
SULPHURIC ACID
HYDROFLUORIC ACID
FORMALDEHYDE
PARAFORMALDEHYDE
FORMALDEHYDE
FORMALDEHYDE
FORMIC ACID
FORMALDEHYDE
FORMIC ACID
FURFURYL ALCOHOL
MALEIC ANHYDRIDE
FURFURYL ALCOHOL
FURFURYL ALCOHOL
FURFURYL ALCOHOL
FURFURYL ALCOHOL
FORMALDEHYDE
ACETIC ACID
CYCLOHEXYLAMINE
HEXAMETHYLENEDIAMINE
HEXAMETHYLENEDIAMINE
HYDROCHLORIC ACID
HYDROGEN CHLORIDE
SODIUM CYANIDE
HYDROFLUORIC ACID
HYDROGEN FLUORIDE
HYDROFLUORIC ACID
HYDROGEN CHLORIDE
HYDROGEN PEROXIDE

<u>SYNONYM</u>	<u>COMPOUND NAME</u>
HYDROGEN FLUORIDE	HYDROGEN FLUORIDE
HYDROGEN PEROXIDE	HYDROGEN PEROXIDE
HYDROGEN SULFIDE	HYDROGEN SULFIDE
HYDROXYBENZENE	PHENOL
2-HYDROXYETHYLAMINE	MONOETHANOLAMINE
2-HYDROXYMETHYLFURAN	FURFURYL ALCOHOL
HYDROXYTOLUENES	CRESOLS
HYLENE T	TOLUENE 2,4-DIISOCYANATE (TDI)
LEAD TETRAETHYL	TETRAETHYL LEAD
LEAD TETRAMETHYL	TETRAMETHYL LEAD
LIQUID AMMONIA	AMMONIA ANHYDROUS
MALEIC ANHYDRIDE	MALEIC ANHYDRIDE
MDI	DIPHENYLMETHANEDIISOCYANATE (MDI)
MERCURIALIN	METHYLAMINE
METHANAL	FORMALDEHYDE
METHANOIC ACID	FORMIC ACID
METHYLAMINE	METHYLAMINE
METHYLBENZENE	TOLUENE
METHYLBENZOL	TOLUENE
METHYL CHLORIDE	METHYL CHLORIDE
METHYL CHLOROFORM	1,1,1-TRICHLOROETHANE
METHYL CYANIDE	ACETONITRILE
METHYLENE CHLORIDE	DICHLOROMETHANE
METHYLENE DICHLORIDE	DICHLOROMETHANE
METHYLENE OXIDE	FORMALDEHYDE
METHYL OXIRANE	PROPYLENE OXIDE
METHYLPHENOLS	CRESOLS
MIXTURE OF BENZENE, TOLUENE, AND XYLENES	NAPHTHA, COAL TAR
MONDUR TDS	TOLUENE 2,4-DIISOCYANATE (TDI)
MONOETHANOLAMINE	MONOETHANOLAMINE
MONOMETHYLAMINE	METHYLAMINE
MORPHOLINE	MORPHOLINE
MURIATIC ACID	HYDROCHLORIC ACID

<u>SYNONYM</u>	<u>COMPOUND NAME</u>
NACCONATE 100	TOLUENE 2,4-DIISOCYANATE (TDI)
NAPHTHA COAL TAR	NAPHTHA COAL TAR
NAPHTHALENE	NAPHTHALENE
NAPHTHALINE	NAPHTHALENE
NITRIC ACID	NITRIC ACID
OIL OF VITRIOL	SULPHURIC ACID
2-OXOHEXAMETHYLENIMINE	CAPROLACTAM
ORTHOPHOSPHORIC ACID	PHOSPHORIC ACID
OXALIC ACID	OXALIC ACID
OXIRANE	ETHYLENE OXIDE
OXYTOLUENES	CRESOLS
PARADI	P-DICHLOROBENZENE
PARADICHLOROBENZENE	P-DICHLOROBENZENE
PARADOW	P-DICHLOROBENZENE
PARAFORM	PARAFORMALDEHYDE
PARAFORMALDEHYDE	PARAFORMALDEHYDE
PCB	POLYCHLORINATED BIPHENYL (PCB)
PCP	PENTACHLOROPHENOL
PENTA	PENTACHLOROPHENOL
PENTACHLOROPHENOL	PENTACHLOROPHENOL
1-PENTANOL	N-AMYL ALCOHOL
PENTYL ALCOHOL	N-AMYL ALCOHOL
PERCHLOROETHYLENE	PERCHLOROETHYLENE
PERCLEN	PERCHLOROETHYLENE
PEROXIDE	HYDROGEN PEROXIDE
PHENOL	PHENOL
PHENOXY PESTICIDES	2,4-DICHLOROPHENOXYACETIC ACID
PHENYLAMINE	ANILINE
N-PHENYLANILINE	DIPHENYLAMINE
PHENYLETHANE	ETHYLBENZENE
PHENYLMETHANE	TOLUENE
PHOSPHORIC ACID	PHOSPHORIC ACID
PHOSPHORUS	PHOSPHORUS

SYNONYM

PHOSPHORUS, WHITE
POLYCHLORINATED BIPHENYL (PCB)
POLYFORMALDEHYDE
POLYOXYMETHYLENE
1-PROPANOL
PROPENAMIDE 50 PER CENT
2-PROPENENITRILE
PROPYL ALCOHOL
N-PROPYL ALCOHOL
PROPYLENE OXIDE
QUICKLIME
SANTOPHEN 20
SODIUM CYANIDE
SULPHUR CHLORIDE
SULPHUR DIOXIDE
SULPHURETTED HYDROGEN
SULPHURIC ACID
SULPHURIC ACID, SPENT
SULPHURIC CHLOROXYDRIN
SULPHUR MONOCHLORIDE
SULPHUR SUBCHLORIDE
SUPEROXOL
TAR CAMPHOR
TDI
TEL
TETRA ALKYL LEAD
TETRACAP
TETRACHLOROETHYLENE
TETRACHLOROMETHANE
TETRAETHYL LEAD
TETRAHYDRO-P-OXAZINE
TETRAHYDRO-2H-1,4-OXAZINE
TETRAMETHYL LEAD

COMPOUND NAME

PHOSPHORUS
POLYCHLORINATED BIPHENYL (PCB)
PARAFORMALDEHYDE
PARAFORMALDEHYDE
N-PROPYL ALCOHOL
ACRYLAMIDE
ACRYLONITRILE
N-PROPYL ALCOHOL
N-PROPYL ALCOHOL
PROPYLENE OXIDE
CALCIUM OXIDE
PENTACHLOROPHENOL
SODIUM CYANIDE
SULPHUR MONOCHLORIDE
SULPHUR DIOXIDE
HYDROGEN SULPHIDE
SULPHURIC ACID
SULPHURIC ACID
CHLOROSULPHURIC ACID
SULPHUR MONOCHLORIDE
SULPHUR MONOCHLORIDE
HYDROGEN PEROXIDE
NAPHTHALENE
TOLUENE 2,4-DIISOCYANATE (TDI)
TETRAETHYL LEAD
TETRAETHYL LEAD OR TETRAMETHYL LEAD
PERCHLOROETHYLENE
PERCHLOROETHYLENE
CARBON TETRACHLORIDE
TETRAETHYL LEAD
MORPHOLINE
MORPHOLINE
TETRAMETHYL LEAD

SYNONYMCOMPOUND NAME

TITANIC CHLORIDE	TITANIUM TETRACHLORIDE
TITANIUM TETRACHLORIDE	TITANIUM TETRACHLORIDE
TML	TETRAMETHYL LEAD
TOLUENE	TOLUENE
2,4-TOLUENE DIISOCYANATE	TOLUENE 2,4-DIISOCYANATE (TDI)
TOLUENE 2,4-DIISOCYANATE (TDI)	TOLUENE 2,4-DIISOCYANATE (TDI)
TOLUOL	TOLUENE
TOXILIC ANHYDRIDE	MALEIC ANHYDRIDE
1,1,1-TRICHLOROETHANE	1,1,1-TRICHLOROETHANE
TRICHLOROETHANE	1,1,1-TRICHLOROETHANE
TRICHLOROETHENE	TRICHLOROETHYLENE
TRICHLOROETHYLENE	TRICHLOROETHYLENE
TRICHLOROMETHANE	CHLOROFORM
TRICLENE	TRICHLOROETHYLENE
2,4,4-TRIMETHYL-1-PENTENE	DIISOBUTYLENE
TRIOXYMETHYLENE	PARAFORMALDEHYDE
UNSLAKED LIME	CALCIUM OXIDE
VAM	VINYL ACETATE
VANADIC ANHYDRIDE	VANADIUM PENTOXIDE
VANADIUM PENTAOXIDE	VANADIUM PENTOXIDE
VANADIUM PENTOXIDE	VANADIUM PENTOXIDE
VCL	VINYL CHLORIDE
VCM	VINYL CHLORIDE
VINEGAR ACID	ACETIC ACID
VINYL ACETATE	VINYL ACETATE
VINYL A MONOMER	VINYL ACETATE
VINYL CHLORIDE	VINYL CHLORIDE
VINYL C MONOMER	VINYL CHLORIDE
VINYL CYANIDE	ACRYLONITRILE
VYAC	VINYL ACETATE
WHITE CYANIDE	SODIUM CYANIDE
WHITE PHOSPHORUS	PHOSPHORUS
YELLOW PHOSPHORUS	PHOSPHORUS

ACETIC ACID

Colourless, watery liquid with strong vinegar odour



SYNONYMS

Glacial acetic acid, Ethanoic, Vinegar acid

UN No. **2789**
2790

HEALTH HAZARDS

Toxicity group II, IDLH = 1000 ppm, TLV = 10 ppm

Vapour

Irritating to nose and throat.

If inhaled, causes coughing, nausea, vomiting or difficult breathing.

Odour threshold = 1.0 ppm

Liquid or Solid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Combustible.

Vapour may explode if ignited in an enclosed area.

Irritating vapours generated when heated - emits toxic fumes on decomposition.

REACTIVITY

Sinks and mixes with water with no reaction.

Attacks most common metals, including most stainless steel.

MONITORING METHODS

1. Colorimetric detector tube for acetic acid, e.g. Drager (12.5 to 199 mg/m³), Gastec (2.5 to 199 mg/m³), MSA (12.45 to 996 mg/m³).

Interferents: Acetic acid anhydride is indicated with lower sensitivity. Other acids are also indicated (e.g. 5 ppm HCl), but with different sensitivities.

2. Collection on activated coconut charcoal and desorption with formic acid and analysis by gas chromatography with a flame ionization detector. The range is 12.5 to 50 mg/m³ using a 173-litre sample. See method no. 1a (NIOSH S169).
3. Collection on impregnated sodium carbonate W41 filter, extraction with water and analysis by ion chromatography using Anion Separator and Suppressor columns with 0.00015M NaHCO₃ as the eluent. See method no. 1b.

SAFETY MEASURES

Avoid contact with liquid or vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, DO NOT induce vomiting; may drink water or milk.

ACETIC ACID

PHYSICAL PROPERTIES	S.G. 1.05 B.P. 118°C V.P. 11.4 mm V.D. 2.1 F.Pt. 40°C (CC) Sol. miscible in all proportions
MANUFAC- TURERS	Not manufactured in Ontario. Celanese Canada Ltd., Montreal. Tel. (514)878-1581
NOTES	

ACETIC ANHYDRIDE

Colourless, watery liquid with strong vinegar odour



SYNONYMS

Ethanoic anhydride, Acetic oxide

UN No. 1715

HEALTH HAZARDS

Toxicity group II, IDLH = 1000 ppm, TLV = 5 ppm

Vapour

Will burn eyes.

Irritating to nose and throat.

If inhaled, causes nausea, vomiting or difficult breathing.

Odour threshold = 0.14 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Combustible.

Vapour may explode if ignited in enclosed area.

Irritating vapours are generated when heated - emits toxic fumes on decomposition.

REACTIVITY

Sinks and reacts slowly with water to form acetic acid.

MONITORING METHODS

1. Colorimetric detector tube for acetic acid. The reading multiplied by 4 gives the amount of ppm of acetic anhydride, e.g. Drager (5 to 80 ppm).

Interferents: acetic acid and other acids (e.g. hydrogen chloride) also give a positive test.

2. TAGA: detection limit is $< 1 \text{ in } 10^9$, ($< 1 \text{ ppb}$).
3. Midget Impinger collection and colorimetric analysis. Sample is collected in a standard midget bubbler charged with an alkaline solution containing hydroxylamine. The resulting product is reacted with ferric chloride to form a purple complex. The absorbance is measured at 540 nm. See method no. 2 (NIOSH S170).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, DO NOT induce vomiting; may drink water or milk.

ACETIC ANHYDRIDE

PHYSICAL PROPERTIES	S.G. 1.08 B.P. 140°C V.P. 4 mm V.D. 3.5 F.Pt. 49°C (CC) Sol. dissolves and decomposes
MANUFAC- TURERS	Not manufactured in Ontario. Celanese Canada Limited, Edmonton, Alta. Tel. (403)477-0546.
NOTES	

ACETONITRILE

Colourless, watery liquid with a sweet odour



SYNONYMS

Cyanomethane, Ethanenitrile, Methyl cyanide

UN No.1648

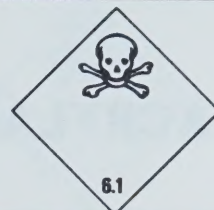
HEALTH HAZARDS	High concentrations cause rapid death. Highly toxic by inhalation and skin absorption. Toxicity group I, IDLH = 4,000 ppm, TLV = 40 ppm <u>Vapour</u> Irritating to eyes, nose and throat. If inhaled, will cause difficult breathing. Odour threshold = 40 ppm <u>Liquid</u> Irritating to skin and eyes. Harmful if swallowed.
FIRE HAZARDS	Flammable. Poisonous gases and toxic vapour are produced when heated. Flashback along vapour trail may occur. Vapour may explode if ignited in an enclosed area. Vapour is heavier than air.
REACTIVITY	Floats and mixes with water with no reaction. Products of decomposition are highly toxic fumes of cyanides.
MONITORING METHODS	1. Adsorption on charcoal, desorption with benzene and analysis by gas chromatograph equipped with a flame ionization detector. The range of measurement is 31.4 to 140.2 mg/m³, using a 10-litre sample. See method no. 3 (NIOSH S165).
SAFETY MEASURES	Wear self-contained breathing apparatus and goggles. Stay upwind. Treat as cyanide.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration, if laboured, give oxygen. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk.

ACETONITRILE

PHYSICAL PROPERTIES	S.G. 0.78 B.P. 81°C V.P. 100 mm (27°C) V.D. 1.4 F.Pt. 12.8°C (CC) Sol. miscible
MANUFAC- TURERS	Caledon Laboratories Ltd., Georgetown. Tel. (416)877-0101
NOTES	

ACRYLAMIDE

Colourless, odourless liquid



SYNONYMS Acrylic amide 50%, Propenamide 50%

UN No.2074

HEALTH HAZARDS

Toxicity group I, TLV = 0.3 mg/m³

Vapour

Irritating to eyes, nose and throat.
Harmful if inhaled.

No data available for odour threshold.

Liquid

Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Not flammable.
Toxic oxides of nitrogen may form in fire.

REACTIVITY

Sinks and mixes with water.
Polymerization may occur above 50°C.

MONITORING METHODS

1. Collection with an all-glass midget impinger containing deionized water and analysis by high pressure liquid chromatography (HPLC).
(Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with liquid.
Wear rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

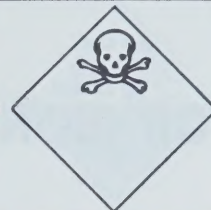
If swallowed and victim is conscious, drink water or milk, INDUCE vomiting. If unconscious keep victim warm only.

ACRYLAMIDE

PHYSICAL PROPERTIES	S.G. 1.05 (25°C) B.P. 125°C at 25 mm V.P. 0.007 mm V.D. 2.46 F.Pt. not flammable Sol. 205 g/100 ml
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131
NOTES	

ACRYLONITRILE

Colourless to light yellow watery liquid with irritating odour



SYNONYMS

2-Propenenitrile, Vinyl cyanide, Cyanoethylene

UN No.1093

HEALTH HAZARDS

Toxic by inhalation, ingestion or skin absorption. Carcinogen.

Toxicity group I, IDLH = 4000 ppm, TLV = 2 ppm

Vapour

Poisonous if inhaled.

Irritating to eyes.

Odour threshold = 21.4 ppm (sense of smell fatigues rapidly).

Liquid

Poisonous if swallowed. Contact with skin may produce welts.

FIRE HAZARDS

Highly flammable liquid.

Poisonous gases (hydrogen cyanide and nitrous oxides) produced in fire.

Vapour may explode if ignited in an enclosed area.

REACTIVITY

Floats on water with no reaction.

Attacks copper and copper alloys and aluminum at high concentrations. Penetrates leather.

MONITORING METHODS

1. Colorimetric detector tube for acrylonitrile, e.g. Drager (1.1 to 65 mg/m³), Gastec (1.1 to 796 mg/m³), MSA (11.1 to 332 mg/m³).

Interferents: Readily cleaved organic cyanide compounds give a similar reaction. HCl, HCN, H₂S and SO₂ are indicated even with the ampoule unbroken.

2. Air is drawn through a small tube containing a sorbent (carbosieve 1B) to trap the organic vapours present. The chemical is desorbed in methanol and an aliquot injected into a gas chromatograph equipped with a flame ionization detector. The standard range is 40 to 1100 mg/m³ using a 20 litre sample. See method no. 4 (P & CAM 202).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind. DO NOT wear leather shoes.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, INDUCE vomiting; if victim is unconscious, keep warm.

ACRYLONITRILE

PHYSICAL PROPERTIES	S.G. 0.81 B.P. 77°C V.P. 83 mm V.D. 1.8 F.Pt. -1.1°C (CC) Sol. 7.35 g/100 ml
MANUFAC- TURERS	Not manufactured in Canada. Distributors: Polysar Limited, Sarnia. Tel. (519)337-8251 Dupont of Canada Ltd., Maitland. Tel. (613)348-3611 Monsanto Canada Inc., Mississauga. Tel. (416)824-9222
NOTES	

ALUMINUM CHLORIDE

Yellow-grayish crystals or powder with irritating odour



SYNONYMS

Anhydrous aluminum chloride

UN No.1726

HEALTH HAZARDS

Severe respiratory irritant.
Toxicity group II, TLV = 5 ppm.

Dust

Irritating to eyes, nose and throat.
Harmful if inhaled.

Odour threshold = 1 to 5 ppm (hydrogen chloride)

Solid

Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Not flammable.

REACTIVITY

Sinks and mixes with water evolving hydrogen chloride gas and heat.
Extremely corrosive to steel and most metals (when wet).

MONITORING METHODS

1. Colorimetric detector tube for hydrogen chloride. The reading divided by 3 gives ppm aluminum chloride, e.g. Drager (1.5 to 30.4 mg/m³), Gastec (0.3 to 61 mg/m³), MSA (3.04 to 760 mg/m³).

Interferents: Chlorine and nitrogen oxides are also indicated.

2. Collection on mixed cellulose membrane filters, digestion with nitric acid and analysis by atomic absorption spectrophotometry (AAS). See method no. 5 (NIOSH 173 or P & CAM 173).

SAFETY MEASURES

Avoid contact with solid or dust.
Wear goggles, self-contained breathing apparatus and rubber over-clothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID

Inhalation

Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk.

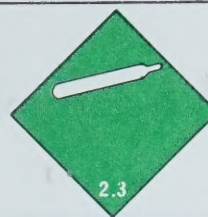
DO NOT induce vomiting.

ALUMINUM CHLORIDE

PHYSICAL PROPERTIES	S.G. 2.4 (25°C) B.P. 190°C at 2.5 atm V.P. 1 mm at 100°C V.D. not pertinent F. Pt. not flammable Sol. 70 g/100 ml (150°C)
MANUFAC- TURERS	Welland Chemical of Canada Ltd., Sarnia. Tel. (519) 336-2287.
NOTES	

AMMONIA (Anhydrous)

Colourless, liquefied compressed gas with sharp ammonia odour



SYNONYMS

Liquid Ammonia

UN No.1005

HEALTH HAZARDS

Toxicity group II, IDLH = 500 ppm, TLV = 25 ppm

Vapour

Poisonous if inhaled.

Irritating to eyes, nose and throat.

Odour threshold = 46.8 ppm

Liquid

Will burn eyes and skin.

Harmful if swallowed.

Causes frostbite.

FIRE HAZARDS

Combustible.

Presence of oil or other combustible materials increases fire hazard.

REACTIVITY

Floats and boils on water, and dissolves with mild heat effect.

Poisonous, visible vapour cloud is produced.

Corrosive to copper and galvanized surfaces.

MONITORING METHODS

1. Colorimetric detector tube for ammonia, e.g. Drager (3.5 to 486 mg/m³), Gastec (0.71 to 227, 200 mg/m³), MSA (3.55 to 1,136 mg/m³).

Interferents: Aliphatic amines are also indicated, but with lower sensitivity.

2. TAGA: detection limit is < 1 in 10^9 , $< (1 \text{ ppb})$.
3. Air is passed through a vertical glass tube ("denuder tube"), of which, the inside is coated with oxalic acid. After sampling the coating is dissolved in water and the NH_4^+ amount may be determined by ion chromatography. Minimum detection limits in water are between 50 and 100 ppb. See method no. 6.
4. Same as in 3 but analysis is done using NH_4^+ selective electrodes.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

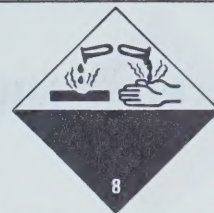
If swallowed and victim is conscious, drink water or milk; do not rub affected areas; DO NOT induce vomiting.

AMMONIA (Anhydrous)

PHYSICAL PROPERTIES	S.G. 0.62 for liquid (15.5°C) B.P. -34°C V.P. 10 atm (26°C) V.D. 0.6(0°C) F. Pt. none Sol. 89.9 g/100 ml (0°C)
MANUFAC- TURERS	C.I.L. Courtright, Tel. (519)867-2739 Cyanamid of Canada Ltd., Niagara Falls. Tel. (416) 356-9000 Genstar Chemical Ltd., Maitland, Tel. (613)348-3681 The Steel Company of Canada Ltd., Hilton Works Hamilton, Tel. (416)528-2511
NOTES	

AMMONIUM HYDROXIDE

Colourless, watery liquid with ammonia odour



SYNONYMS

Ammonia water, Aqueous ammonia

UN No.2672

HEALTH HAZARDS

Liquid and vapour extremely irritating, especially to eyes.
Toxicity group II, IDLH = 500 ppm, TLV = 25 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes nausea, vomiting, difficult breathing, or loss of consciousness.

Odour threshold = 50 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Not flammable.

Emits toxic fumes when heated.

REACTIVITY

Floats and mixes with water, with mild liberation of heat.
Corrosive to copper, copper alloys, aluminum alloys and galvanized surfaces.

MONITORING METHODS

1. Colorimetric detector tube for ammonia, e.g. Drager (3.5 to 486 mg/m³), Gastec (0.71 to 227,200 mg/m³), MSA (3.55 to 1,136 mg/m³).

Interferents: Aliphatic amines are also indicated, but with lower sensitivity.

2. TAGA: detection limit is < 1 in 10⁹, (< 1 ppb).

3. NH₄⁺ concentration may be determined using an ion specific electrode. Interference from amines, when present, can be avoided by using ion chromatography instead of the electrode. See method no. 6.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting.

AMMONIUM HYDROXIDE

PHYSICAL PROPERTIES	S.G. 0.9 (15.5°C) B.P. not pertinent V.P. 475 mm (15.5°C) V.D. not pertinent F. Pt. not flammable Sol. very soluble
MANUFACTURERS	Genstar Chemical Ltd., Maitland. Tel. (613)348-3681 Cyanamid of Canada Ltd., Niagara Falls. Tel. (416)356-9000
NOTES	

n-AMYL ALCOHOL

Colourless liquid with a mild, sweet odour



SYNONYMS

Pentyl alcohol, 1-Pentanol, n-Butylcarbinol

UN No. 1105

HEALTH HAZARDS

Moderately toxic by ingestion and inhalation.
Toxicity group II, IDLH = 150 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes coughing, nausea, headache, or difficult breathing.

Odour threshold = 0.12 ppm

Liquid

Irritating to eyes. Non-irritating to skin.

Harmful if swallowed.

FIRE HAZARDS

Flammable.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Irritating vapour is produced.

REACTIVITY

Floats on water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for alcohol, e.g. Drager, Gastec, MSA.
2. TAGA: detection limit is < 1 to 10^9 , (< 1 ppb).
3. Adsorption on charcoal, desorption with carbon disulphide containing 5% 2 - propanol, and analysis by gas chromatograph equipped with a flame ionization detector. (Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with liquid and vapour.
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

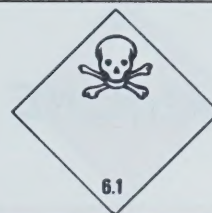
Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk.

n-AMYL ALCOHOL

PHYSICAL PROPERTIES	S.G. 0.82 (15°C) B.P. 138°C V.P. 1.0 mm (14°C) V.D. 3.04 F.Pt. 25°C (CC) Sol. 2.7 g/100 ml (22°C)
MANUFAC- TURERS	Caledon Laboratories Limited, Georgetown. Tel. (416)877-0101
NOTES	

ANILINE

Colourless to yellowish brown, oily liquid with weak odour



SYNONYMS

Aminobenzene, Aniline oil, Phenylamine, Blue Oil

UN No.1547

HEALTH HAZARDS

Highly toxic by skin, inhalation or ingestion.
Rapidly absorbed by skin.
Toxicity group II, IDLH = 100 ppm, TLV = 5 ppm

Odour threshold = 0.5 ppm

Liquid
Poisonous if swallowed or if skin is exposed.
Irritating to eyes.

FIRE HAZARDS

Combustible.
Poisonous gases and toxic vapours are generated when heated.
Vapour may explode if ignited in enclosed area.

REACTIVITY

Sinks slowly in water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for aniline, e.g. Drager (1 to 20 ppm).
2. TAGA: detection is ≤ 1 in 10^{12} , (≤ 1 ppt).
3. Adsorption on silica gel, desorption with 95% ethanol and analysis by gas chromatograph equipped with a flame ionization detector. The range is 9.54 to 38.2 mg/m³ using a 20 litre sample. See method no. 7 (NIOSH S310).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus.
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.
Inhalation
Move to fresh air.
Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk;
INDUCE vomiting.

ANILINE

PHYSICAL PROPERTIES	S.G. 1.02 B.P. 184°C V.P. 0.6 mm V.D. 3.2 F.Pt. 70°C (CC) Sol. 3.7 g/100 ml (30°C)
MANUFAC- TURERS	Not manufactured in Canada. Distribution: Uniroyal Ltd., Chemical Division, Elmira. Tel. (519)669-8222
NOTES	

BENZENE

Colourless, watery liquid with a gasoline-like odour



SYNONYMS

Benzol, Benzole

UN No. 1114

HEALTH HAZARDS

Poisoning occurs through inhalation and penetration of the skin. Carcinogen.

Toxicity group II, IDLH = 2,000 ppm, TLV = 10 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes headache, difficulty breathing, or loss of consciousness.

Odour threshold = 4.7 ppm

Liquid

Irritating to skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Flammable.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Vapour is heavier than air.

REACTIVITY

Floats on water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for benzene, e.g. Drager (163 to 1,340 mg/m³), Gastec (0.82 to 391 mg/m³), MSA (16.3 to 652 mg/m³)

Interferents: other aromatic compounds (e.g. toluene and xylene) and petroleum hydrocarbons are also indicated, but the sensitivity of indication is different.

2. TAGA: detection limit is < 1 in 10⁶, (< 1 ppm).

3. Adsorption on charcoal, desorption with carbon disulphide and analysis by a gas chromatograph equipped with a flame ionization detector. The range of measurements is 13 to 51.8 ppm using a 2 litre sample. See method no. 8 (NIOSH S311).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, DO NOT induce vomiting.

BENZENE

PHYSICAL PROPERTIES

S.G. 0.88
B.P. 81°C
V.P. 75 mm
V.D. 2.7
F.Pt. -11°C (CC)
Sol. 0.18 g/100 ml

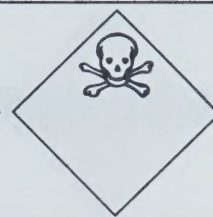
MANUFAC- TURERS

Esso Chemical Canada, Sarnia. Tel. (519)339-2000
Petrosar Ltd., Corunna. Tel. (519) 862-2911
Polysar Ltd., Sarnia. Tel. (519)337-8251
Shell Canada Ltd., Corunna. Tel. (519)862-1491
Sunchem, Division of Sunoco Inc., Sarnia. Tel. (519)337-2301
Texaco Canada Ltd., Mississauga. Tel. (416)278-5511

NOTES

BROMINE

Reddish-brown watery liquid with a sharp irritating odour



SYNONYMS

UN No.1744

HEALTH HAZARDS

Liquid and vapour highly toxic and severe skin irritant.

Toxicity group I, IDLH = 10 ppm, TLV = 0.1 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes coughing, difficult breathing or loss of consciousness.

Odour threshold = 3.5 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Not flammable.

May cause fire on contact with combustibles.

Toxic and irritating gases are produced in fire.

REACTIVITY

Sinks in water with no reaction.

Reacts violently with aluminum. Causes fire on contact with wood, cotton and straw. Corrodes iron, steel and copper. Attacks plastics.

MONITORING METHODS

1. Colorimetric detector tube for halogens, e.g. Drager (1.4 to 200 mg/m³), Gastec (13.1 to 150 mg/m³), MSA (33.3 to 1,332 mg/m³).

Interferents: chlorine dioxide, nitrogen dioxide are also indicated but with different sensitivities.

2. Hi-volume air sampling and fluorometric analysis. See method no. 9a.
3. Collection on activated charcoal, followed by neutron activation analysis. See method no. 9b.
4. Spectrophotometric monitoring followed by flow injection analysis. See method no. 9c.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration (but NOT mouth-to-mouth). If laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting.

BROMINE

PHYSICAL PROPERTIES	S.G. 3.12 B.P. 59°C V.P. 175 mm (21°C) V.D. no data available F.Pt. not flammable Sol. 3.58 g/100 ml
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Dow Chemical of Canada Ltd., Sarnia. Tel. (519) 339-3131
NOTES	

n-BUTYL ACRYLATE

Colourless, watery liquid with a sharp, fragrant odour



SYNONYMS	Butyl acrylate, n-Butyl 2-propenoate, Acrylic acid n-butyl ester	UN No.2348
HEALTH HAZARDS	Toxicity group I, TLV = 10 ppm No data available for odour threshold. <u>Liquid</u> Irritating to skin and eyes. Harmful if swallowed.	
FIRE HAZARDS	Combustible. Containers may explode in fire. Can react with oxidizing materials.	
REACTIVITY	Floats on water with no reaction. Will polymerize on application of heat; bulk polymerization can be explosive.	
MONITORING METHODS	1. Collection on midget impinger containing 0.1N sodium hydroxide and analysis by high pressure liquid chromatography (HPLC). (Suggested method only, proven sampling method not available.)	
SAFETY MEASURES	Wear full protective clothing. Avoid contact with liquid. Keep upwind.	
FIRST AID	CALL FOR MEDICAL AID. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk. If unconscious or having convulsions, do nothing but keep victim warm. <u>Inhalation</u> Move to fresh air.	

n-BUTYL ACRYLATE

PHYSICAL PROPERTIES	S.G. 0.90 B.P. 145°C V.P. 3 mm V.D. 4.42 F.Pt. 49°C (OC) Sol. 0.16 g/100 ml	HEALTH HAZARDS
MANUFACTURERS	Not manufactured in Canada. Distributor: Rohm and Haas Canada Ltd., West Hill. Tel. (416)284-4711	FIRE HAZARDS
NOTES		SAFETY MEASURES
		FIRST AID

CALCIUM OXIDE

White to grey solid granules with no odour



SYNONYMS

Unslaked lime, Quicklime, Burnt lime, Calx

UN No. 1910

HEALTH HAZARDS

Caustic irritant to eyes and respiratory tract.
Toxicity group II, IDLH = 250 mg/m³, TLV = 5 mg/m³

Dust

Irritating to nose and throat.

No data available for odour threshold.

Solid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Not flammable.

May cause fire on contact with water and combustibles.

REACTIVITY

Sinks and reacts violently with water to form calcium hydroxide.
Water appears to boil. Reaction with materials only when water is present, and heat is liberated.

MONITORING METHODS

1. Collection on mixed cellulose ester membrane filter (0.8 µm), extraction in dilute HNO₃ acid and analysis by atomic absorption spectrophotometry using an oxidizing air-acetylene flame. A hollow cathode lamp for calcium is used. See method no. 10 (NIOSH S205).

SAFETY MEASURES

Avoid contact with solid.

Wear rubber overclothing, including gloves.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

Contact

Brush off material from skin and clothing.

Contact of calcium oxide in presence of moisture will cause burns.

Flush eyes immediately with plenty of water.

If swallowed, give milk or water; DO NOT induce vomiting.

CALCIUM OXIDE

PHYSICAL PROPERTIES	S.G. 3.40 B.P. 2,850°C V.P. 0 mm V.D. not pertinent F.Pt. not flammable Sol. 0.13 g/100 ml (10°C)
MANUFAC- TURERS	Domtar Inc., Chemicals Group, Beachville. Tel. (519)423-6261 The Steel Co. of Canada Ltd., Chemical-Lime Works, Ingersoll. Tel. (519)485-2730
NOTES	

CAPROLACTAM

Colourless liquid, white flakes or molten solid with a mild odour

SYNONYMS	Aminocaproic lactam, 2-Oxohexamethylenimine	UN No. N/A
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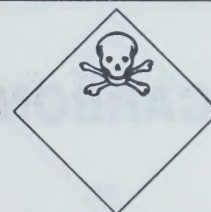
HEALTH HAZARDS	Toxicity group I, TLV = 5 ppm Odour threshold = 0.3 mg/m³ <u>Liquid</u> Irritating to skin and eyes. Harmful if swallowed.
FIRE HAZARDS	Combustible. Decomposes to carbon monoxide and hydrogen cyanide in fires.
REACTIVITY	Sinks and mixes with water with no reaction.
MONITORING METHODS	1. Collection in midget impingers containing deionized water or ethanol and analysis by ultraviolet spectrophotometry. The C-O and N-H absorption bands will identify the compound. Quantitation is accomplished by means of external standards. (Suggested method only, proven sampling method not available.)
SAFETY MEASURES	Avoid contact with liquid. Wear goggles, self-contained breathing apparatus and rubber gloves and boots.
FIRST AID	CALL FOR MEDICAL AID. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk.

CAPROLACTAM

PHYSICAL PROPERTIES	S.G. 1.02 (77°C) B.P. 268°C V.P. 3 mm (100°C) V.D. 3.91 F.Pt. 110°C (CC) Sol. soluble
MANUFAC- TURERS	Badische Canada Ltd., Arnprior. Tel. (613) 623-3191 Badische Ltd., Williamsburg, Virginia. Tel. (804) 887-6739
NOTES	

CARBON DISULPHIDE

Colourless to yellow, watery liquid with a rotten egg to sweet odour



SYNONYMS

Carbon bisulphide

UN No. 1131

HEALTH HAZARDS

Toxic by oral intake or prolonged contact with skin.
Acts on central nervous system as narcotic or anesthetic in acute poisoning.
Toxicity group II, IDLH = 500 ppm, TLV = 10 ppm.

Vapour

Irritating to eyes, nose and throat.
If inhaled, causes nausea, vomiting, difficult breathing.
or loss of consciousness.
Odour threshold = 0.21 ppm

Liquid

Will burn skin and eyes. Harmful if swallowed.

FIRE HAZARDS

Flammable.
Vapour is heavier than air.
Flashback along vapour trail may occur. Vapour may explode if ignited in an enclosed area. Toxic gases are generated.

REACTIVITY

Sinks in water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for carbon disulphide, e.g. Drager (15.9 to 10,150 mg/m³), Gastec (15.9 to 17,000 mg/m³), MSA (11.7 to 3,510 mg/m³).
2. TAGA: detection limit is < 1 in 10⁹, (< 1 ppb).
3. Adsorption on charcoal, desorption with benzene and analysis by a gas chromatograph equipped with a flame photometric detector, with a sulphur filter. A column (6 ft. x ¼ in. O.D. Glass) packed with 5% OV-17 on 80/100 mesh Gas Chrom Q is used. The range of measurement is 14.7 to 58.8 ppm using a 6-litre sample. See method no. 11 (NIOSH S248).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water. If swallowed and victim is conscious INDUCE vomiting by giving warm soapy water - repeat 3 times, until vomitus is clear.

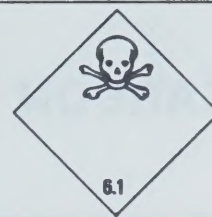
CARBON DISULPHIDE

CARBON DISULPHIDE

PHYSICAL PROPERTIES	S.G. 1.27 B.P. 46°C V.P. 300 mm V.D. 2.7 F.Pt. -30°C (CC) Sol. 0.22 g/100 ml (22°C)	HEALTH HAZARDS
MANUFACTURERS	Cornwall Chemicals Ltd., Cornwall. Tel. (613)932-9540	FIRE HAZARDS
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

CARBON TETRACHLORIDE

Colourless, heavy liquid with a sweet odour



SYNONYMS

Carbon tet, Tetrachloromethane

UN No.1846

HEALTH HAZARDS

Highly toxic by ingestion, inhalation and skin absorption.
Carcinogen.

Toxicity group II, IDLH = 300 ppm, TLV = 10 ppm.

Vapour

Poisonous if inhaled.

Irritating to eyes.

Odour threshold = > 10 ppm

Liquid

Poisonous if swallowed.

Irritating to skin and eyes.

FIRE HAZARDS

Not flammable.

Poisonous and irritating phosgene, chloride and hydrogen chloride gases are produced in fire.

REACTIVITY

Sinks in water with no reaction.

With excess water, gives off phosgene, hydrogen chloride and hydrocarbon products.

MONITORING METHODS

1. Colorimetric detector tube for carbon tetrachloride, e.g. Drager (31.5 to 314 mg/m³), Gastec (6.3 to 384 mg/m³), MSA (64 to 1280 mg/m³).

Interferents: Phosgene is also indicated but with different sensitivities.

2. Adsorption on charcoal, desorption with carbon disulfide and analysis by gas chromatography and flame ionization detection. The range is 65 to 299 mg/m³ for a 17-litre sample. See method no. 12 (NIOSH S314).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

INDUCE vomiting.

CARBON TETRACHLORIDE

PHYSICAL PROPERTIES

S.G. 1.59
B.P. 77°C
V.P. 91 mm
V.D. 5.3
F.Pt. not flammable
Sol. 0.12 g/100 ml (25°C)

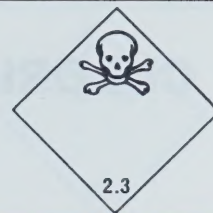
MANUFAC- TURERS

Cornwall Chemicals Ltd., Cornwall. Tel. (613)932-9540
Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131

NOTES

CHLORINE

Greenish yellow liquefied compressed gas with an irritating, bleach-like choking odour



SYNONYMS

UN No. 1017

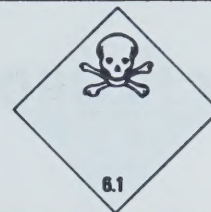
HEALTH HAZARDS	Toxic gas. Liquid chlorine causes serious skin burns. Extremely irritating to eyes and respiratory tract. Toxicity group I, IDLH = 25 ppm, TLV = 1.0 ppm <u>Vapour</u> Poisonous if inhaled. Will burn eyes. Odour threshold = 3.5 ppm <u>Liquid</u> Will burn skin and eyes. Causes frostbite.
FIRE HAZARDS	Not flammable. May cause fire on contact with combustibles. Poisonous gases and toxic products are produced in fires.
REACTIVITY	Sinks and boils in water to form a corrosive solution. Poisonous, visible vapour cloud is produced. Reacts with most metals at high temperature.
MONITORING METHODS	1. Colorimetric detector tube for chlorine, e.g. Drager (125 to 1250 mg/m³), Gastec (0.92 to 44 mg/m³), MSA (0.14 to 44 mg/m³). <u>Interferents:</u> Bromine, chlorine dioxide and nitrogen dioxide are also indicated, but the sensitivities of indication are different. 2. A measured volume of air is passed through a fritted bubbler containing 100 ml of dilute methyl orange. The dye is quantitatively bleached by free chlorine and the extent of bleaching can be determined colorimetrically at 505 nm. The range is 0.05 to 1.0 ppm for a 30-litre air sample. See method no. 13 (P & CAM 209).
SAFETY MEASURES	Avoid contact with liquid and vapour. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves). Stay upwind.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration (but NOT mouth-to-mouth); if laboured, give oxygen. If in eyes, flush with plenty of water. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes with plenty of water. Wash skin with plenty of water and soap. Do not rub affected areas.

CHLORINE

PHYSICAL PROPERTIES	S.G. 1.56 for liquid (-34°C) B.P. -34°C V.P. 5.01 atm V.D. 3.2 for gas (0°C, 1 atm) F.Pt. not flammable Sol. 0.83 g/100 ml (15.5°C)
MANUFAC- TURERS	C.I.L., Cornwall. Tel. (613)932-9540 Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131 Reed Ltd., Chemical Division, Dryden. Tel. (807)223-2323 Welland Chemical Ltd., Mississauga. Tel. (416)625-5690
NOTES	

CHLOROFORM

Colourless, watery liquid with a sweet odour



SYNONYMS

Trichloromethane

UN No.1888

HEALTH HAZARDS

Causes narcosis and heart damage. Carcinogen.
Toxicity group II, IDLH = 1,000 ppm, TLV = 10 ppm

Vapour

Irritating to eyes, nose and throat.
If inhaled causes headache, dizziness, nausea, or loss of consciousness.

Odour threshold = 203 to 307 ppm

Liquid

Irritating to skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Not flammable.
Poisonous and irritating phosgene and hydrogen chloride gases are produced when heated.

REACTIVITY

Sinks in water with no reaction. With excess water, decomposes to give phosgene and hydrogen chloride. Exposed to air and sunlight, oxidizes to phosgene.

MONITORING METHODS

1. Colorimetric detector tube for chloroform, e.g. Drager (125 to 1250 mg/m³), Gastec (0.92 to 44 mg/m³), MSA (124 to 1990 mg/m³).
2. Adsorption on charcoal, desorption with carbon disulphide and analysis by gas chromatography with flame ionization detection. The nominal detection limit is 0.10 mg/sample for a minimum sample volume of 0.5-litres and a maximum sample volume of 13-litres. See method no. 14 (NIOSH 5151 or P & CAM 127).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

CHLOROFORM

PHYSICAL PROPERTIES	S.G. 1.49 B.P. 61°C V.P. 160 mm V.D. 4.1 F.Pt. not flammable Sol. 0.8g/100 ml (25°C)
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Dow Chemical of Canada Ltd., Sarnia. Tel. (519) 339-3131
NOTES	

CHLOROSULPHONIC ACID

Colourless to light yellow liquid with a sharp, choking odour



SYNONYMS

Chlorsulphonic acid, Sulphuric chlorohydrin

UN No. 1754

HEALTH HAZARDS

Highly toxic. Produces severe acid burns.
Toxicity group I, TLV = 5 ppm

Vapour

Irritating to eyes, nose and throat.
Harmful if inhaled.

Odour threshold = 1 to 5 ppm

Liquid

Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Not flammable.
May cause fire on contact with combustibles.
Decomposes into irritating and toxic gases.

REACTIVITY

Reacts violently with water, forming hydrochloric acid and sulphuric acid. Contact with water and metal produces explosive hydrogen gas.

MONITORING METHODS

1. Colorimetric detector tube for sulphur dioxide, e.g. Drager (2.62 to 1,310 mg/m³), Gastec (2.62 to 209,000 mg/m³), MSA (2.62 to 1,048 mg/m³).
2. Flame photometric detector or gas chromatography equipped with a flame photometric detector. Detection limit is ≤ 5 ppb, e.g. Meloy, Tracor.
3. Differential UV absorption. Detection limit is 1 ppb, e.g. Marss 200.
4. Pulsed Fluorescence. Detection limit is 1 ppb, e.g. TECO.

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

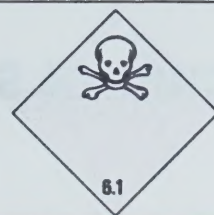
DO NOT induce vomiting.

CHLOROSULPHONIC ACID

PHYSICAL PROPERTIES	S.G. 1.79 (25°C) B.P. 158°C V.P. 1.0 mm (32°C) V.D. 4.0 F.Pt. not flammable Sol. decomposes to H ₂ SO ₄ - HCl
MANUFAC- TURERS	Not manufactured in Canada. Distributors: Du Pont of Canada Ltd., Toronto. Tel: (416) 362-5621
NOTES	

CRESOLS

Colourless or yellow watery liquid, or solid crystals with a sweet tarry odour



SYNONYMS

Cresylic acids, Hydroxytoluenes, Methylphenols, Oxytoluenes

UN No.2022

HEALTH HAZARDS

Corrosive to body tissue. Production of severe burns and dermatitis. Toxic by inhalation, ingestion and skin absorption. Toxicity group II, IDLH = 250 ppm, TLV = 5 ppm.

Odour threshold = 5 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Combustible.

Flammable toxic vapours and poisonous gas are generated in fire.

REACTIVITY

Sinks in water with some solubility; no reaction.

MONITORING METHODS

1. TAGA: detection limit is < 1 in 10^6 , (< 1 ppm).
2. Colorimetric detector tube for phenol. Cresols give a positive test but with a different sensitivity than phenol, e.g. Drager (19 mg/m^3).
3. Collection on silica gel sorbent tube, desorption with acetone and analysis by gas chromatography equipped with flame ionization detection. The range is 10.54 to 42.2 mg/m^3 using a 20-litre sample. See method no. 15 (NIOSH S167).

SAFETY MEASURES

Avoid contact with liquid.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing is laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; induce vomiting immediately.

CRESOLS

PHYSICAL PROPERTIES

S.G. 1.04
B.P. 191 to 203°C
V.P. 0.1 to 0.25 mm
V.D. 3.7
F.Pt. 80 to 85°C (OC) and (CC)
Sol. 1.9 to 2.5 g/100 ml

MANUFAC- TURERS

Not manufactured in Canada.
Distributor:
Domtar Chemicals Group, Mississauga. Tel. (416)625-4240

NOTES

CYCLOHEXYLAMINE

Colourless, liquid with a strong fishy odour



SYNONYMS

Aminocyclohexane, Hexahydroaniline

UN No.2357

HEALTH HAZARDS

Highly toxic by ingestion, inhalation and skin absorption.
Severe eye and respiratory irritant. Vapours cause nausea.
Burns skin on contact.

Toxicity group I, TLV = 10 ppm
No data available for odour threshold.

Liquid
Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Flammable.
Flashback along vapour trail may occur.
Vapour forms explosive mixture with air.
Emits highly toxic fumes when heated to decomposition.

REACTIVITY

Floats and mixes with water with no reaction.
Reacts vigorously with oxidizing materials.

MONITORING METHODS

1. Adsorption on silica gel, desorption with sulphuric acid and analysis by gas chromatography with a flame ionization detector. The range of measurement is 1 to 2400 mg/m³ in a 10-litre sample of air. See method no. 16 (NIOSH221 or P & CAM 221).

SAFETY MEASURES

Avoid contact with liquid.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.
Move to fresh air.
Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk;
DO NOT induce vomiting.

CYCLOHEXYLAMINE

PHYSICAL PROPERTIES	S.G. 0.86 B.P. 135°C V.P. no data available V.D. 3.42 F.Pt. 32°C (OC) Sol. no data available
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Ashland Chemical/Solvents Division, Toronto. Tel: (416) 651-2822
NOTES	

1,4-DICHLOROBENZENE

White to clear solid crystals with a mothballs odour



SYNONYMS

p-Dichlorobenzene, Dichloride, Paradi, Paradow

UN No.1592

HEALTH HAZARDS

Toxicity group II, IDLH = 1,000 ppm, TLV = 75 ppm
Odour threshold = 15 to 30 ppm
Solid
Irritating to skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Combustible.
Poisonous gases and irritating vapours (chlorine, hydrogen chloride and phosgene) are generated in fires.

REACTIVITY

Sinks in water with no reaction.

MONITORING METHODS

1. Adsorption on activated charcoal, followed by desorption with carbon disulphide and analysis by gas chromatography with flame ionization or electron capture detection.
See method no. 17 (NIOSH S281).

SAFETY MEASURES

Avoid contact with solid.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

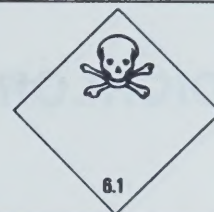
CALL FOR MEDICAL AID.
Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.
Contact
Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water and soap if available. If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

1,4-DICHLOROBENZENE

PHYSICAL PROPERTIES	S.G. 1.46 B.P. 174°C V.P. 0.4 mm V.D. 5.07 F.Pt. 66°C (CC) Sol. 0.01 g/100 ml
MANUFAC- TURERS	Not manufactured in Ontario. Record Chemical Co. Inc., Montreal. Tel. (514)341-3550
NOTES	

DICHLOROMETHANE

Colourless, watery liquid with a sweet pleasant odour



SYNONYMS

Methylene chloride, Methylene dichloride

UN No.1593

HEALTH HAZARDS

Absorbed by skin. Induces narcosis. Very dangerous to eyes.
Toxicity group III, IDLH = 5,000 ppm, TLV = 200 ppm

Vapour

Irritating to eyes, nose and throat.
If inhaled, causes nausea and dizziness.

Odour threshold = 205 to 307 ppm

Liquid

Irritating to skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Not flammable.
Toxic and irritating phosgene gas produced in fire.

REACTIVITY

Sinks in water with slight solubility - with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for methylene chloride, e.g. Drager (347 to 7060 mg/m³), MSA (353 to 9800 mg/m³).

Interferents: other halogenated hydrocarbons and organic compounds (e.g. petroleum) and carbon monoxide are indicated.

2. Adsorption on charcoal, desorption with carbon disulphide and analysis by gas chromatography and flame ionization detection or electron capture detection. The range is 1700 to 7100 mg/m³ for a 1 - litre sample. See method no. 18 (NIOSH S329).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

DICHLOROMETHANE

PHYSICAL PROPERTIES	S.G. 1.32 (25°C) B.P. 40°C V.P. 350 mm V.D. 2.9 F.Pt. not flammable Sol. 2.0 g/100 ml
MANUFACTURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131
NOTES	

2,4-DICHLOROPHENOXYACETIC ACID

White powder with a slight phenolic odour



SYNONYMS 2,4-D, Phenoxy pesticides

UN No.2765

HEALTH HAZARDS	Moderately toxic by ingestion and skin absorption. Toxicity group II, IDLH = 500 mg/m ³ , TLV = 10 mg/m ³ No data available for odour threshold. <u>Solid</u> Poisonous if swallowed. Skin contact poisonous.
FIRE HAZARDS	Combustible. Toxic and irritating hydrogen chloride or phosgene gases may form in fire.
REACTIVITY	Sinks in water with no reaction. Corrosive.
MONITORING METHODS	1. Collection on glass fibre filter desorption with methanol and analysis by high pressure liquid chromatography. The range is 5.1 to 20.3 mg/m ³ using a 100-litre sample of air. See method no. 19 (NIOSH S279).
SAFETY MEASURES	Wear goggles, self-contained breathing apparatus and special protective clothing. Stay upwind.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water; INDUCE vomiting.

2,4-DICHLOROPHENOXYACETIC ACID

PHYSICAL PROPERTIES	S.G. 1.56 B.P. 160°C (0.4mm) V.P. ≈ 0 mm V.D. not pertinent F.Pt. not flammable Sol. 0.06 g/100 ml (25°C)
MANUFACTURERS	Not manufactured in Ontario. Uniroyal Chemical, Division of Uniroyal Ltd., Sherwood Park, Alta. Tel. (403) 467-5551
NOTES	

DIISOBUTYLENE

Colourless liquid with a gasoline-like odour



SYNONYMS

2,4,4-Trimethyl-1-pentene

UN No. 2050

HEALTH HAZARDS

Irritant and narcotic in high concentrations.
Mildly toxic by inhalation.
Toxicity group II

Vapour
Irritating to eyes, nose and throat.
If inhaled, causes dizziness, headache, difficult breathing or loss of consciousness.

No data available for odour threshold.

Liquid
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.

FIRE HAZARDS

Flammable.
Flashback along vapour trail may occur.
Vapour may explode if ignited in an enclosed area.
When heated to decomposition, emits highly toxic vapours.

REACTIVITY

Floats on water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for ethylene. The reading multiplied by 200 will give the concentration of di-isobutylene, e.g. Drager, Gastec, MSA.

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, and rubber overclothing (including gloves).
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk.
DO NOT induce vomiting.

DIISOBUTYLENE

PHYSICAL PROPERTIES	S.G. 0.72 B.P. 102°C V.P. 0.001 mm V.D. 3.8 F.Pt. 2°C (CC) Sol. insoluble
MANUFAC- TURERS	Polysar Limited, Sarnia. Tel. (519)337-8251
NOTES	

DIPHENYLAMINE

Light tan to brown solid or liquid with a pleasant odour



SYNONYMS Anilinobenzene, N-Phenylaniline

UN No. N/A

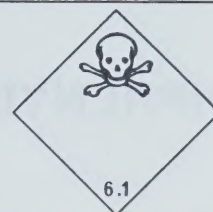
HEALTH HAZARDS	Toxicity group I, TLV = 10 mg/m³ <u>Dust</u> Irritating to eyes, nose and throat. Harmful if inhaled. No data available for odour threshold. <u>Liquid or Solid</u> Irritating to skin and eyes. Harmful if swallowed.
FIRE HAZARDS	Combustible. Toxic oxides of nitrogen may form in fire. Dust may be explosive if mixed with air in critical proportions and in presence of a source of ignition.
REACTIVITY	Sinks in water with no reaction.
MONITORING METHODS	1. Adsorption on silica gel, desorption with sulphuric acid and analysis by gas chromatograph with a flame ionization detector. (Suggested method only, proven sampling method not available.) 2. TAGA: detection limit is < 1 in 10⁹, (< 1 ppb).
SAFETY MEASURES	Avoid contact with liquid and solid. Wear goggles, self-contained breathing apparatus and rubber overclothing.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen. If in eyes, hold eyelids open and flush with plenty of water. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water. DO NOT induce vomiting.

DIPHENYLAMINE

PHYSICAL PROPERTIES	S.G. 1.07 for liquid (61°C) B.P. 302°C V.P. 1.0 mm (108°C) V.D. not pertinent F.Pt. 153°C (OC) Sol. insoluble
MANUFACTURERS	Not manufactured in Canada. Distributor: Cyanamid of Canada, Willowdale. Tel. (416)498-9405
NOTES	

DIPHENYL METHANE DIISOCYANATE

White to light yellow solid



SYNONYMS

MDI, Diphenylmethane-4,4'-diisocyanate

UN No.2489

HEALTH HAZARDS

Moderately toxic. Strong irritant.
Toxicity group I, TLV = 0.02 ppm

No data available for odour threshold.

Solid
Irritating to skin and eyes.

FIRE HAZARDS

Combustible.
Toxic vapour of hydrogen cyanide generated when heated.
Vapour is heavier than air.

REACTIVITY

Sinks in water, with slow reaction that forms carbon dioxide gas.
Polymerization may occur slowly with contact of moisture - not hazardous.

MONITORING METHODS

1. Collection in midget impinger containing 10 ml nitro reagent and analysis by high pressure liquid chromatography (HPLC). The range is 0.007 to 0.073 ppm using a 20-litre sample.

See method no. 20 (NIOSH 142).

SAFETY MEASURES

Avoid contact with solid.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including butyl rubber gloves).

FIRST AID

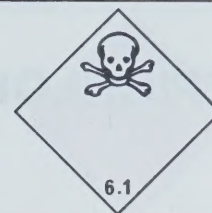
CALL FOR MEDICAL AID.
Inhalation
Move to fresh air.
If breathing is laboured, give oxygen.
Contact
Remove contaminated clothing and shoes.
Flush eyes with plenty of water.
Wash skin with soap and water.

DIPHENYL METHANE DIISOCYANATE

PHYSICAL PROPERTIES	S.G. 1.26 B.P. 392°C V.P. 0.001 mm (40°C) V.D. 1.2 F.Pt. 219°C (OC) Sol. insoluble
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Bayer (Canada) Inc., Mississauga. Tel. (416)625-6110
NOTES	

EPICHLOROHYDRIN

Colourless, watery liquid with a sweet garlic odour



SYNONYMS

1-Chloro-2,3-epoxypropane, 3-Chloro-1,2-propylene oxide

UN No.2023

HEALTH HAZARDS

Highly toxic by ingestion, inhalation and skin absorption.
Irritant and allergen.

Toxicity group I, IDLH = 100 ppm, TLV = 2 ppm

Vapour

Poisonous if inhaled.

Irritating to eyes.

Odour threshold = 10 ppm

Liquid

Poisonous if swallowed.

Will burn skin and eyes.

FIRE HAZARDS

Combustible.

Poisonous gases of phosgene are produced in fire.

Vapour may explode if ignited in an enclosed area.

Can react with oxidizing materials.

REACTIVITY

Sinks and mixes with water with a mild reaction not likely to be hazardous. Polymerizes with strong acids and bases, particularly when hot.

MONITORING METHODS

1. Colorimetric detector tube for epichlorohydrin, e.g. Drager (5 to 50 ppm).

Interferents: other (easily cleaved) halogenated hydrocarbons are indicated (e.g. trichloroethylene).

2. Adsorption on charcoal, desorption with carbon disulphide and analysis by gas chromatography equipped with a flame ionization detector. The range of measurement is 11.7 to 43.1 mg/m³ for a 20-litre sample. See method no. 21a (NIOSH S118).
3. Gas chromatography - mass fragmentography instrumentation. The determination of the fragment of m/e 49 in diethyl ether is possible at the level of 6 ppb. See method no. 21b. Alternatively TAGA instrumentation may be used.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk, INDUCE vomiting immediately.

EPICHLOROHYDRIN

PHYSICAL PROPERTIES	S.G. 1.18 B.P. 115°C V.P. 13 mm V.D. 3.3 F.Pt. 38°C (CC) Sol. 6 g/100 ml (25°C)
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131
NOTES	

ETHYLBENZENE

Colourless liquid with a sweet, gasoline-like odour



SYNONYMS

EB, Phenylethane, Ethylbenzol

UN No. 1175

HEALTH HAZARDS

Moderately toxic by ingestion, inhalation and skin absorption.
Strong irritant. Narcotic in high concentrations.
Toxicity group III, IDLH = 2,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.
If inhaled, causes dizziness and difficult breathing.

Odour threshold = 140 ppm

Liquid

Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Flammable.
Flashback along vapour trail may occur.
Vapour may explode if ignited in an enclosed area.
Irritating vapours are generated when heated.
Vapour is heavier than air.

REACTIVITY

Floats on water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for ethylbenzene, e.g. Drager (132 to 1760 mg/m³), Gastec (31 to 3080 mg/m³), MSA (220 to 2200 mg/m³).

Interferents: other aromatic compounds (e.g. toluene and xylene) are indicated, but with different sensitivities.

2. Adsorption on charcoal, desorption with carbon disulphide and analysis by a gas chromatography equipped with a flame ionization detector. A column (10 ft. x 1/8 in. stainless steel) packed with 10% FFAP on 80/100 mesh, acid washed DMCS. Chromosorb W is used. The range of measurement is 222 to 884 mg/m³ for a 10-litre sample size. See method no. 22 (NIOSH S29).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting.

ETHYLBENZENE

PHYSICAL PROPERTIES	S.G. 0.87 (20°C) B.P. 136°C V.P. 7 mm V.D. 3.66 F.Pt. 15°C Sol. 0.02 g/100 ml
MANUFAC- TURERS	Polysar Ltd., Sarnia. Tel. (519)337-8251
NOTES	

ETHYL CHLORIDE

Colourless liquid or gas with a pungent odour



SYNONYMS

Chloroethane, Ether hydrochloric

UN No.1037

HEALTH HAZARDS

Inhalation produces narcotic and anesthetic effects.
Slight eye, skin and respiratory irritant.
Toxicity group I, IDLH = 20,000 ppm, TLV = 1,000 ppm

Vapour

Irritating to eyes, nose and throat.
If inhaled causes dizziness or loss of consciousness.
No data available for odour threshold.

Liquid

Will cause frost bite.
Irritating to skin and eyes.

FIRE HAZARDS

Flammable.
Flashback along vapour trail may occur. Vapour may explode if ignited in an enclosed area. Toxic and irritating phosgene gas produced in fire. Vapour is heavier than air.

REACTIVITY

Floats and may boil on water, with slight solubility.
Reacts with water or steam to produce toxic and corrosive fumes.

MONITORING METHODS

1. Colorimetric detector tube for phosgene, e.g. Drager (0.2 to 310 mg/m³), Gastec (0.4 to 371 mg/m³), MSA (0.4 to 40 mg/m³).
Interferents: Carbonyl bromide and acetyl chloride is also indicated.
2. Adsorption on charcoal, desorption of ethyl chloride with carbon disulphide and analysis by gas chromatography with flame ionization detection. The range is 1590 to 6500 mg/m³ for a 3-litre sample volume. See method no. 23 (NIOSH S105).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
Do not rub affected areas, which appear frostbitten.

ETHYL CHLORIDE

ETHYL CHLORIDE

Colourless liquid or gas with a pungent odour

SYNONYMS

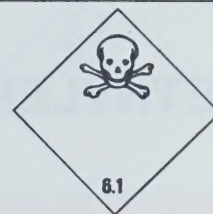
Chloroethane, Ethyl hydrochloride

UN No. 1903

PHYSICAL PROPERTIES	S.G. 0.91 (12.2°C) for liquid B.P. 13°C V.P. 1,000 mm V.D. 2.22 F.Pt. -43°C (OC) Sol. 0.57 g/100 ml	HEALTH HAZARDS
MANUFACTURERS	Ethyl Canada Inc., Corunna. Tel. (519)862-1411	FIRE HAZARDS
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

ETHYLENE DIBROMIDE

Colourless liquid with a sweet odour



SYNONYMS

1,2-Dibromoethane, Ethylene Bromide, EDB

UN No.1605

HEALTH HAZARDS

Toxic by inhalation, skin contact or ingestion.
Strongly irritating to eyes, skin and respiratory tract.
Toxicity group II, IDLH = 400 ppm, TLV = 20 ppm

Vapour

Poisonous if inhaled.
Irritating to eyes, nose and throat.
Odour threshold = 26 ppm

Liquid

Irritating to eyes and skin.
Poisonous if swallowed or if skin is exposed.

FIRE HAZARDS

Not flammable.
Toxic and irritating gases (bromides) are produced when heated.
Reacts vigorously with metals such as aluminum and magnesium.

REACTIVITY

Sinks in water with no reaction.
Poisonous vapour is produced when heated.
Slowly decomposes in presence of light.

MONITORING METHODS

1. Collection on activated charcoal desorption with carbon disulphide and analysis by gas liquid chromatography with flame ionization detection or electron capture detection. The range is 110 to 470 mg/m³ using a 1-litre sample. See method no. 24 (NIOSH S104).

SAFETY MEASURES

Avoid contact with liquid or vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk.

ETHYLENE DIBROMIDE

PHYSICAL PROPERTIES	S.G. 2.18 B.P. 131°C V.P. 11 mm V.D. 6.5 F.Pt. not flammable Sol. 0.43 g/100 ml (30°C)
MANUFACTURERS	Not manufactured in Canada. Distributor: Chorney Chemical Co., Toronto. Tel. (416) 236-1296
NOTES	

ETHYLENE DICHLORIDE

Colourless liquid with a sweet odour



SYNONYMS

1,2-Dichloroethane, EDC, Ethylene Chloride

UN No. 1184

HEALTH HAZARDS	Toxic by inhalation, skin contact or ingestion. Very serious eye irritant. Narcotic. Potential carcinogen. Toxicity group I, IDLH = 1,000 ppm, TLV = 10 ppm <u>Vapour</u> Irritating to eyes, nose and throat. If inhaled, causes nausea, dizziness or difficulty breathing. Odour threshold = 100 ppm <u>Liquid</u> Will burn skin and eyes. Harmful if swallowed.
FIRE HAZARDS	Flammable. Flashback along vapour trail may occur. Vapour is heavier than air. Vapour may explode if ignited in an enclosed area. Toxic and irritating hydrogen chloride and phosgene gases are produced in fire.
REACTIVITY	Sinks in water, with very slight solubility, and no reaction.
MONITORING METHODS	1. Colorimetric detector tube for phosgene, e.g. Drager (0.2 to 310 mg/m³), Gastec (0.4 to 371 mg/m³), MSA (0.4 to 40 mg/m³). <u>Interferents:</u> Carbonyl bromide reacts similarly. Acetyl chloride is also indicated. 2. Colorimetric detector tube for hydrogen chloride, e.g. Drager (1.5 to 30.4 mg/m³), Gastec (0.3 to 61 mg/m³), MSA (3.04 to 760 mg/m³). 3. Adsorption on charcoal, desorption of ethylene dichloride with carbon disulphide and analysis by gas chromatography and flame ionization detection or electron capture detection. See method no. 14.
SAFETY MEASURES	Avoid contact with liquid and vapour. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes with plenty of water. Wash skin with plenty of water. If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

ETHYLENE DICHLORIDE

PHYSICAL PROPERTIES	S.G. 1.26 B.P. 84°C V.P. 62 mm V.D. 3.4 F.Pt. 12.8°C (CC) Sol. 0.8 g/100 ml
MANUFACTURERS	Caledon Laboratories Ltd., Georgetown. Tel. (416)877-0101 Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131 Ethyl Canada Inc., Corunna. Tel. (519)862-1411
NOTES	

ETHYLENE OXIDE

Colourless, liquefied gas with a sweet odour



SYNONYMS

1,2-Epoxyethane, Oxirane

UN No.1040

HEALTH HAZARDS

Highly toxic. Irritating to skin and eyes.
Toxicity group II, IDLH = 800 ppm, TLV = 50 ppm

Vapour

Irritating to eyes, nose and throat.
If inhaled, causes nausea, vomiting and difficult breathing.

Odour threshold = 50 ppm

Liquid

Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Flammable. Vapour is heavier than air.
Flashback along vapour trail may occur.
Vapour may explode if ignited in an enclosed area.
Irritating vapours generated when heated.

REACTIVITY

Floats and mixes with water with a slow reaction - not hazardous.
Polymerizes violently if contaminated with alkaline or acidic materials and metal oxides or chlorides.

MONITORING METHODS

1. Colorimetric detector tube for ethylene oxide, e.g. Drager (45 to 900 mg/m³), Gastec (1,800 to 53,900 mg/m³).

Interferents: readily oxidized organic compounds (e.g. alcohols) are also indicated.

2. Adsorption on charcoal, desorption with carbon disulphide and analysis by gas chromatography with flame ionization detection. The range is 41 to 176 mg/m³ for a 5-litre sample. See method no. 25 (NIOSH S286).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk.

ETHYLENE OXIDE

PHYSICAL PROPERTIES	S.G. 0.87 for liquid B.P. 11°C V.P. 1,097 mm V.D. 1.5 F.Pt. -18°C () Sol. Completely miscible	HEALTH HAZARDS
MANUFACTURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131	REACTIVITY
NOTES		FIRST AID

FORMALDEHYDE

Colourless, watery liquid with an irritating odour



SYNONYMS

Formalin, Formalith, Formic aldehyde, Fyde, Methanal, Methylene oxide

UN No. 1198

HEALTH HAZARDS

Highly toxic by inhalation, ingestion or skin contact.
Irritant to eyes, skin and respiratory tract.

Toxicity group II, IDLH = 100 ppm, TLV = 2 ppm

Odour threshold = 0.8 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Combustible.

Toxic vapours are generated.

REACTIVITY

Sinks and mixes with water with no reaction.

Forms corrosive formic acid when heated in air.

MONITORING METHODS

1. Colorimetric detector tube for formaldehyde, e.g. Drager (0.61 to 50 mg/m³), Gastec (2.5 to 25 mg/m³), MSA (1.25 to 125 mg/m³).

Interferents: other aldehydes (e.g. acetaldehyde, acrolein) and styrene will turn the indicating layer yellow to brown.

2. Collection on oxidizer impregnated charcoal, extraction with 0.1% hydrogen peroxide for 1 hour and analysis by ion chromatography. Nominal detection limit in 20 mls of solution is 0.05 mg/l. Lower detection limits are attainable by modifying the system. See method no. 26a.
3. Collection in midjet impinger containing 0.10g of 4,5 - dihydroxy - 2,7 - naphthalene disulfonic acid disodium salt in 10 ml of water. The absorbance of the coloured solution is read in a spectrophotometer at 580 nm. The range is 0.10 ppm to 2.0 ppm using a 25-litre air sample. See method no. 26b (NIOSH S173 or P & CAM 125).

SAFETY MEASURES

Avoid contact with liquid vapour.

Wear gas-tight goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink warm water, and INDUCE vomiting. Repeat.

FORMALDEHYDE

PHYSICAL PROPERTIES	S.G. 1.1 (25°C) B.P. -19°C V.P. 827 mm (38°C) V.D. 1.1 F.Pt. 49.5 to 83.5°C (CC) Sol. soluble
MANUFACTURERS	Borden Chemical Canada Division, Borden Products Ltd., West Hill. Tel. (416)286-1000 North Bay. Tel. (705)474-6500 Reichhold Chemicals Ltd., North Bay. Tel. (705)474-7460 Thunder Bay. Tel. (807)577-6414 Bakelite Thermosets Ltd., Belleville. Tel. (613)968-5501
NOTES	

FORMIC ACID

Colourless liquid with a penetrating odour



SYNONYMS

Formylic acid, Methanoic acid

UN No.1779

HEALTH HAZARDS

Highly toxic by inhalation or ingestion on short exposure.
Produces blisters and burns on contact. Strong irritant to eyes.
Toxicity group II, IDLH = 100 ppm, TLV = 5 ppm
Odour threshold = 21 ppm
Liquid
Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Combustible.
Toxic vapour is generated in fires.

REACTIVITY

Sinks and mixes with water with no reaction.
Undergoes slow decomposition at room temperature.
Strong oxidizer.

MONITORING METHODS

1. Colorimetric detector tube for formic acid, e.g. Drager (1.9 to 28 mg/m³).
Interferents: other acids (e.g. acetic acid, hydrogen chloride) are also indicated.
2. Collection in a midjet impinger containing 0.1 N NaOH. Derivatization of formic acid to ethyl formate and analysis by gas chromatography with flame ionization detection. The range is 3.8 to 75 mg/m³ in a 10-litre sample of air. See method no. 27 (NIOSH S173 or P & CAM 232).
3. Collection on impregnated sodium carbonate W41 filter, extraction with deionized water and analysis by ion chromatography. (Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with liquid.
Wear goggles, self-contained breathing apparatus and rubber or neoprene overclothing (including gloves).

FIRST AID

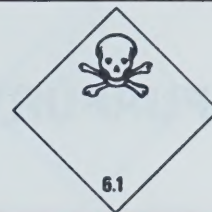
CALL FOR MEDICAL AID.
Move to fresh air.
Contact
Remove contaminated clothing and shoes - promptly.
Flush eyes with plenty of water. Wash skin well with soap and water. If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting.
If unconscious, keep victim warm only.

FORMIC ACID

PHYSICAL PROPERTIES	S.G. 1.22 B.P. 101°C V.P. 23 to 33 mm V.D. 1.6 F.Pt. 59°C (CC) Sol. miscible	
MANUFACTURERS	Not manufactured in Canada. Distributor: Canada Colours and Chemicals Ltd., Toronto. Tel. (416) 924-6831	
NOTES		

FURFURYL ALCOHOL

Colourless to light yellow liquid with a mild, irritating odour



SYNONYMS

2-Hydroxymethylfuran, 2-Furyl-methanol,
2-Furancarbinol, Furfuralcohol

UN No.2874

HEALTH HAZARDS

Toxicity group II, IDLH = 250 ppm, TLV = 5 ppm
Odour threshold = 8 ppm
Liquid
Irritating to skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Combustible.

REACTIVITY

Mixes with water with no reaction.

MONITORING METHODS

1. Colorimetric detector tube for furfuryl alcohol, e.g. MSA (100 to 2,000 mg/m³).
2. Adsorption on Porapak Q, desorption with acetone and analysis by gas chromatograph equipped with a flame ionization detector. The range is 120 to 470 mg/m³ using a 6-litre sample. See method no. 28 (NIOSH S365).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.
Move to fresh air.
Contact
Remove contaminated clothing and shoes.
Flush eyes with plenty of water.
Wash skin with soap and water.
If swallowed and victim is conscious, drink water; INDUCE vomiting.
If unconscious, keep victim warm only.

FURFURYL ALCOHOL

PHYSICAL PROPERTIES	S.G. 1.13 B.P. 170°C V.P. 1.9 mm (32°C) V.D. 3.37 F.Pt. 65°C (CC) Sol. miscible in all proportions
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Ashland Chemical/Solvents Division Valvoline Oil & Chemicals, Toronto. Tel. (416) 651-2822 Sargent-Welsh Scientific of Canada Limited, Weston. Tel. (416) 741-5210
NOTES	

HEXAMETHYLENEDIAMINE

Colourless solid or watery liquid with a weak ammonia odour



SYNONYMS

1,6-Diaminohexane, 1,6-Hexanediamine

UN No.1783

HEALTH HAZARDS

Moderately toxic by ingestion. Strong irritant. Inhalation is extremely dangerous; may be fatal. Toxicity group II.

Odour threshold = 0.0041 mg/m³

Liquid or Solid

Poisonous if swallowed, inhaled or if skin is exposed. Will burn eyes.

FIRE HAZARDS

Combustible.

When heated to decomposition, emits toxic vapours.

Reacts with oxidizing materials.

REACTIVITY

Floats and mixes with water with no reaction.

MONITORING METHODS

1. TAGA: detection limit is < 1 in 10^9 , (< 1 ppb).
2. Collection on XAD-2 sorbent tube, desorption with benzene and analysis by gas chromatograph equipped with a flame ionization detector.
(Suggested method only, proven sampling method not available).

SAFETY MEASURES

Avoid contact with liquid.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Move to fresh air.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk.

HEXAMETHYLENEDIAMINE

PHYSICAL PROPERTIES	S.G. 0.93 for liquid B.P. 205°C V.P. 0.0013 mm V.D. 4.01 F.Pt. 71°C (OC) Sol. very soluble
MANUFAC- TURERS	Du Pont of Canada Ltd., Maitland. Tel. (613)348-3611
NOTES	

HYDROCHLORIC ACID

Colourless, to pale yellow liquid with a sharp irritating odour



SYNONYMS

Muriatic Acid

UN No.1789

HEALTH HAZARDS

Toxic. Eye, skin and respiratory irritant.
Toxicity group II, TLV = 5 ppm

Vapour
Irritating to eyes, nose and throat.
If inhaled, causes coughing or difficult breathing.
Odour threshold = 1 to 5 ppm

Liquid
Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Not flammable.
Flammable gas may be produced on contact with metals.
Toxic and irritating chloride vapour produced when heated.

REACTIVITY

Sinks and mixes with water with reaction. Corrosive to most metals forming hydrogen gas which may form explosive mixtures with air.

MONITORING METHODS

1. Colorimetric detector tube for hydrochloric acid, e.g. Drager (1.5 to 30.4 mg/m³), Gastec (0.3 to 61 mg/m³), MSA (3.04 to 760 mg/m³).
Interferents: Chlorine and nitrous oxides are also indicated, but sensitivity of indication is different.
2. Midget impinger collection in 0.5 M sodium acetate and analysis using a chloride ion specific electrode. See method no. 29 (NIOSH S246).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear chemical-protective suit with self-contained breathing apparatus.
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.

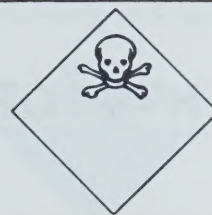
Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting.

HYDROCHLORIC ACID

PHYSICAL PROPERTIES	S.G. 1.1 (20.2% HCl) B.P. -84.9°C V.P. 4 mm (18°C) V.D. no data available F.Pt. not flammable Sol. 82.3 g/100 ml (0°C)
MANUFACTURERS	Allied Chemical Canada Ltd., Amherstburg. Tel. (519)736-2111 C.I.L., Cornwall. Tel. (613)932-9540 Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131 Du Pont of Canada Ltd., Maitland. Tel. (613)348-3611 Reed Ltd., Chemical Division, Dryden. Tel. (807)223-2323
NOTES	

HYDROFLUORIC ACID

Colourless to green watery liquid with an irritating odour



SYNONYMS

Fluorhydric acid, Hydrofluoric acid aqueous

UN No.1790

HEALTH HAZARDS

Highly toxic by inhalation or ingestion. Highly corrosive to skin and mucous membranes.

Toxicity group I, TLV = 3 ppm

Vapour

Will burn eyes, nose and throat.

Harmful if inhaled.

No data available for odour threshold.

Liquid

Will burn skin and eyes. Harmful if swallowed.

FIRE HAZARDS

Not flammable.

Flammable gas may be produced on contact with metals and steel.

Toxic and irritating vapours of fluorides produced when heated.

REACTIVITY

Sinks and mixes with water producing toxic or corrosive fumes. Attacks glass, concrete, sand, natural rubber, leather and many organics.

MONITORING METHODS

1. Colorimetric detector tube for hydrogen fluoride, e.g. Drager (1.5 to 15 ppm).

Interferents: with high relative humidity, hydrogen fluoride mist is produced.

2. TAGA: detection limit is $< 1 \text{ in } 10^9$, ($< 1 \text{ ppb}$).
3. Collection on an alkali - impregnated cellulose pad placed immediately behind a membrane filter and analysis by selective ion electrode. The range is 0.05 to 475 mg/m³. See method no. 30. (NIOSH S176).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear chemical-protective, suit, with self-contained breathing apparatus. Need plastic lens goggles.

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

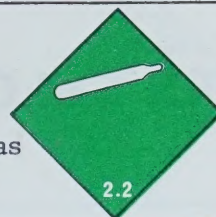
Remove contaminated clothing and shoes. Flush eyes with plenty of water. If swallowed and victim is conscious, drink water or milk. DO NOT induce vomiting.

HYDROFLUORIC ACID

PHYSICAL PROPERTIES	S.G. 1.26 for 70% B.P. 67°C V.P. 100 mm for 70% (15°C) V.D. not available F.Pt. not flammable Sol. very soluble
MANUFAC- TURERS	Allied Chemical Canada Ltd., Amherstburg. Tel. (519)736-2111
NOTES	

HYDROGEN CHLORIDE (Anhydrous)

Colourless to slightly yellow liquefied, compressed gas with an irritating odour.



SYNONYMS Hydrochloric acid, anhydrous

UN No.1050

HEALTH HAZARDS

Toxicity group II, IDLH = 100 ppm, TLV = 5 ppm

Vapour

Poisonous if inhaled.

Irritating to eyes, nose and throat.

Odour threshold = 1 to 5 ppm

Liquid

Poisonous if swallowed.

Will burn skin and eyes.

Causes frostbite.

FIRE HAZARDS

Not flammable.

Flammable and explosive hydrogen gas produced on contact with metals.

Pressurized container explodes and releases toxic and irritating vapours.

REACTIVITY

Sinks and mixes with water producing poisonous vapour cloud of hydrochloric acid.

Highly corrosive to most metals evolving flammable hydrogen gas.

MONITORING METHODS

1. Colorimetric detector tube for hydrogen chloride, e.g. Drager (1.5 to 30.4 mg/m³), Gastec (0.3 to 61 mg/m³), MSA (3.04 to 760 mg/m³).

2. Midget bubbler collection in 0.5M sodium acetate and analysis using a chloride ion specific electrode. The range is 3.5 to 14.0 mg/m³. See method no. 29. (NIOSH S246).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear chemical-protective suit with self-contained breathing apparatus.

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water.

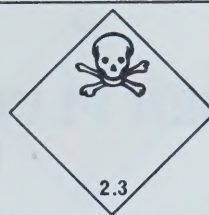
If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting. Do not rub affected areas.

HYDROGEN CHLORIDE (Anhydrous)

PHYSICAL PROPERTIES	S.G. 1.19 for liquid (-85°C) B.P. -85°C V.P. > 1 atm V.D. 1.3 F.Pt. not flammable Sol. 82.3 g/100 ml (0°C)
MANUFAC- TURERS	Dow Chemical of Canada Limited, Sarnia. Tel. (519) 339-3131
NOTES	

HYDROGEN FLUORIDE

Colourless liquid with a sharp, irritating odour



SYNONYMS

Hydrofluoric acid, anhydrous

UN No. 1052

HEALTH HAZARDS

Toxicity group I, IDLH = 20 ppm, TLV = 3 ppm

Vapour

Poisonous if inhaled.

Irritating to eyes, nose and throat.

Odour threshold = 0.03 mg/m³

Liquid

Poisonous if swallowed.

Will burn skin and eyes.

FIRE HAZARDS

Not flammable.

Flammable and explosive hydrogen gas produced on contact with metal and steel.

Toxic and irritating fluoride vapour produced when heated.

REACTIVITY

Sinks and mixes with water evolving heat and poisonous vapour. Attacks glass, concrete, sand, natural rubber, leather and many organics.

MONITORING METHODS

1. Colorimetric detector for hydrogen fluoride, e.g. Drager (1.5 to 15 ppm).

Interferents: with high relative humidity, hydrogen fluoride mist, which is not quantitatively indicated by the tube, can be produced.

2. TAGA: detection limit is < 1 in 10⁹, (< 1 ppb).
3. Collection on an alkali-impregnated cellulose pad placed immediately behind a membrane filter and analysis by selective ion electrode. The range is 0.05 to 475 mg/m³. See method no. 30 (NIOSH S176).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear chemical-protective suit with self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk.

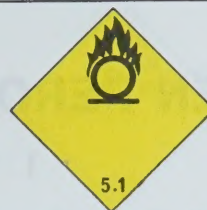
DO NOT induce vomiting.

HYDROGEN FLUORIDE

PHYSICAL PROPERTIES	S.G. 0.98 B.P. 20°C V.P. 780 mm V.D. 2.6 F.Pt. not flammable Sol. very soluble
MANUFAC- TURERS	Allied Chemical Canada Limited, Amherstburg. Tel. (519) 736-2111
NOTES	

HYDROGEN PEROXIDE

Colourless, watery liquid with a slightly sharp odour



SYNONYMS

Albone, Peroxide, Superoxol, Hydrogen dioxide

UN No. 2015

HEALTH HAZARDS

Extremely irritating to eyes, skin and respiratory tract.

Toxicity group II, IDLH = 75 ppm, TLV = 1 ppm

Vapour

Irritating to eyes, nose and throat.

Harmful if inhaled.

No data available for odour threshold.

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Not flammable.

Causes fire and explodes on contact with combustibles and metals.

Containers may explode when heated.

REACTIVITY

Sinks and mixes with water with no reaction.

Rapid decomposition with liberation of oxygen gas on contact with dirt, dust and many metals.

MONITORING METHODS

1. Titanium sulfate, (TiSO_4) colorimetric method-collection in a coarse fritted bubbler containing an aqueous $\text{TiSO}_4/(\text{NH}_4)_2\text{SO}_4/\text{H}_2\text{SO}_4$ solution at a concentration of ~ 50 ppm of Ti (IV). After sampling, the pH of the solution is adjusted to 4.2 ± 0.2 using a sodium acetate buffer and the mixture is shaken with an aliquot of 0.1% 8 - quinolinol in chloroform. The complex is measured colorimetrically at 450nm. See method no. 31a.
2. Luminol, (5 - amino - 2, 3 - dihydro - 1, 4 - phthalazinedione) chemiluminescent method - collection in a midget impinger containing water. The sample is reacted with luminol in the presence of copper (II) nitrate at pH 12.8. The chemiluminescence is measured with a photomultiplier tube at 450 nm. See method no. 31b.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink warm water. INDUCE vomiting.

HYDROGEN PEROXIDE

PHYSICAL PROPERTIES	S.G. 1.29 for 70% B.P. 125°C for 70% V.P. 1 mm (15°C) V.D. not available F.Pt. not flammable Sol. miscible in all proportions
MANUFAC- TURERS	Not manufactured in Canada. Distributors: Du Pont of Canada Ltd., Maitland. Tel. (613)348-3611 Canada Colours and Chemicals Ltd., Toronto. Tel. (416)924-6831
NOTES	

HYDROGEN SULPHIDE

Colourless, liquefied compressed gas with a rotten egg odour, but odourless at poisonous concentrations



SYNONYMS

Sulphuretted hydrogen

UN No. 1053

HEALTH HAZARDS	Highly toxic by ingestion. Asphyxiant - high concentrations can cause almost immediate death. Toxicity group II, IDLH = 300 ppm, TLV = 10 ppm Odour threshold = 0.005 ppm <u>Vapour</u> Poisonous if inhaled. Irritating to eyes and mucous membranes.
FIRE HAZARDS	Flammable. Flashback along vapour trail may occur. May explode if ignited in an enclosed area. Toxic oxides of sulphur produced in fire. Vapour is heavier than air.
REACTIVITY	Dissolves rapidly (boils) in water with no reaction. Poisonous, flammable, visible vapour cloud is produced.
MONITORING METHODS	1. Colorimetric detector tube for hydrogen sulphide, e.g. Drager (1.4 to 99,400 mg/m³), Gastec (565 to 22,600 mg/m³), MSA (1.13 to 73 mg/m³). 2. Flame photometric detector or gas chromatography equipped with a flame photometric detector. Detection limit is < 5 ppb, e.g. Meloy, Tracor. 3. Absorption into alkaline suspension of cadmium hydroxide and analysis by the methylene blue spectrophotometric method. The range is 8.5 to 63 mg/m³ using a 2-litre sample. See method no. 32 (NOISH S4).
SAFETY MEASURES	Avoid contact with gas. Wear chemical-protective suit with self-contained breathing apparatus and rubber boots and gloves. Stay upwind.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air immediately. If breathing has stopped, give artificial respiration; if laboured, give oxygen. <u>Contact</u> Flush eyes and skin with plenty of water for at least 15 minutes.

HYDROGEN SULPHIDE

PHYSICAL PROPERTIES	S.G. 1.5 for gas (0°C) B.P. -60°C V.P. 20 atm (26°C) V.D. 1.2 (0°C) F.Pt. 260°C (CC) Sol. 4/1 (Vol. gas/Vol. H ₂ O) (0°C)
MANUFAC- TURERS	Cornwall Chemicals Ltd., (C.I.L.), Cornwall. Tel. (613)938-5500
NOTES	

MALEIC ANHYDRIDE

Colourless solid crystals, tablets or molten, with a choking odour



SYNONYMS

Toxilic anhydride, cis-Butanedioic anhydride, 2,5-Furanedione, Maleic acid hydride

UN No. 2215

HEALTH HAZARDS

Strong irritant. Highly toxic by ingestion or inhalation.
Toxicity group I, TLV = 0.25 ppm₃
Odour threshold = 1.3 to 2.0 mg/m³
Liquid or Solid
Will burn skin and eyes.
Harmful if swallowed.

FIRE HAZARDS

Combustible.
Dust cloud may be ignited by spark or flames, generating heat and toxic fumes.

REACTIVITY

Sinks and mixes slowly with cold water - not hazardous.
Hot water causes frothing.

MONITORING METHODS

1. A known volume of air is drawn through a midjet impinger containing 15 ml of distilled water. Maleic anhydride is hydrolyzed to maleic acid in the bubbler. The resulting sample is analyzed by high pressure liquid chromatography (HPLC) with a UV detector at 254 nm. The range of measurement is 0.50 to 2.14 mg/m³ using a 360-litre sample. See method no. 33 (NIOSH 302 or P & CAM 302).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves). Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Move to fresh air.

Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk.

MALEIC ANHYDRIDE

PHYSICAL PROPERTIES	S.G. 1.43 for solid (5°C) B.P. 200°C V.P. 0.16 mm V.D. 3.38 F.Pt. 102°C (CC) for liquid Sol. soluble
MANUFAC- TURERS	Not manufactured in Ontario. Monsanto Canada Ltd., La Salle, Que. Tel. (514)366-4850
NOTES	

METHYL ACRYLATE

Colourless, watery liquid with a sweet, sharp odour



SYNONYMS

Acrylic acid methyl ester, Methyl 2-propenoate

UN No.1919

HEALTH HAZARDS	Severe eye and respiratory irritant. Absorbed by the skin. Toxicity group II, IDLH = 1,000 ppm, TLV = 10 ppm <u>Vapour</u> Irritating to eyes, nose and throat. If inhaled causes dizziness or difficulty breathing. No data available for odour threshold. <u>Liquid</u> Will burn skin and eyes. Harmful if swallowed.
FIRE HAZARDS	Flammable. Irritating vapours produced in fire. Flashback along vapour trail may occur. Containers may explode when heated. Vapour may explode if ignited in an enclosed area. Vapour is heavier than air.
REACTIVITY	Floats and mixes slowly with water with no reaction. Heat causes explosive polymerization.
MONITORING METHODS	1. Colorimetric detector tube for methyl acrylate, e.g. Drager (5 to 200 ppm). 2. Collection on activated charcoal, desorption with carbon disulfide and analysis by gas chromatography equipped with a flame ionization detection. The range is 13.9 to 58.4 mg/m³ for a 48 litre sample. See method no. 34 (NIOSH S38).
SAFETY MEASURES	Avoid contact with liquid and vapour. Wear chemical-protective suit and self-contained breathing apparatus. Stay upwind.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen. <u>Contract</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

METHYL ACRYLATE

PHYSICAL PROPERTIES	S.G. 0.96 for liquid B.P. 81°C V.P. 68 mm V.D. 3.0 F.Pt. -2.8°C (0C) Sol. 5.2 g/100 ml
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Rohm and Haas Canada Ltd., West Hill. Tel. (416)284-4711
NOTES	

METHYLAMINE

Colourless, liquefied compressed gas with an ammonia-like odour



SYNONYMS

Aminomethane, Mercurialin, Monomethylamine

UN No.1061

HEALTH HAZARDS

Toxicity group I, IDLH = 100 ppm, TLV = 10 ppm
Vapour
Irritating to eyes, nose and throat.
If inhaled, causes coughing or difficult breathing.
Odour threshold = 0.021 ppm
Liquid
Will burn skin and eyes.

FIRE HAZARDS

Flammable. Vapour is heavier than air.
Toxic nitrogen oxides produced in fire.
Containers may explode in fire.
Flashback along vapour trail may occur.
Vapour may explode if ignited in an enclosed area.

REACTIVITY

Mixes with water and boils, with no reaction.
Corrosive to copper, copper alloys, zinc alloys, aluminum and galvanized surfaces.

MONITORING METHODS

1. Colorimetric detector tube for nitrogen dioxide, e.g. Drager (5 to 100 ppm).
Nitrogen oxide is not indicated.
Interferents: ozone and chlorine react in the same way as nitrogen dioxide.
2. TAGA: detection limit is < 1 in 10^9 , (< 1 ppb).
3. Adsorption on silica gel, desorption with methanolic acid, derivatization with benzaldehyde and analysis by gas chromatography with flame ionization detection. The range of measurement is 0.5 to 120 mg/m³ in 100-litre of air sample. See method no. 16 (NIOSH S221, P & CAM 221).

SAFETY MEASURES

Avoid contact with liquid.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.
Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.
Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water or milk;
DO NOT induce vomiting.

METHYLAMINE

METHYLAMINE

Colourless, liquefied compressed gas with an ammonia-like odour

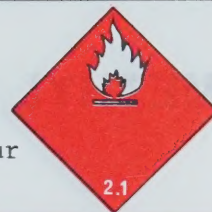
Ammoniacal, N-methylamine, Dimethylamine

SYNONYMS

PHYSICAL PROPERTIES	S.G. 0.69 for liquid (-6.5°C) B.P. -6.3°C V.P. 2 atm (10.1°C) V.D. 1.07 F.Pt. 0°C (CC) Sol. 1.15 g/100 ml (12.5°C)	HEALTH HAZARDS
MANUFACTURERS	Chinook Chemicals Ltd., Sombra. Tel. (519)892-3411	FIRE HAZARDS
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

METHYL CHLORIDE

Colourless, liquefied compressed gas with an odourless or sweet odour



SYNONYMS

Chloromethane

UN No.1063

HEALTH HAZARDS

Highly toxic by ingestion or inhalation.
Has a narcotic action.
Toxicity group I, IDLH = 10,000 ppm, TLV = 100 ppm
Vapour
Not irritating to eyes, nose and throat.
If inhaled, causes nausea, vomiting, headache, difficult breathing or loss of consciousness.
No data available for odour threshold.
Liquid
Causes frostbite.

FIRE HAZARDS

Flammable.
Toxic and irritating gases of chloride produced in fire.
Flashback along vapour trail may occur.
Vapour may explode if ignited in an enclosed area.

REACTIVITY

Floats and boils on water with no reaction. Flammable, visible vapour cloud is formed. Reacts with zinc, aluminum, magnesium - not violent.

MONITORING METHODS

1. A known volume of air is drawn through two tubes in series containing activated charcoal. Methyl chloride is desorbed from the charcoal with methylene chloride and the sample analyzed by gas chromatography with flame ionization detection. The range is 59 to 220 ppm using a 1.5-litre sample size. See method no. 35 (NIOSH S99).

SAFETY MEASURES

Avoid contact with liquid and vapour. Wear gas-tight goggles, self-contained breathing apparatus, chemical-protective suit and rubber gloves.
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.
Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.
Contact
Remove contaminated clothing and shoes.
Flush skin with plenty of water.
Do not rub affected areas.
DO NOT wash eyes with water; open eyelids wide to evaporate.

METHYL CHLORIDE

PHYSICAL PROPERTIES	S.G. 1.04 B.P. -24°C V.P. 4.8 atm V.D. 1.7 F.Pt. < 0°C (CC) Sol. slightly soluble	HEALTH HAZARDS
MANUFACTURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131	HAZARDS
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

MONOETHANOLAMINE

Colourless, oily liquid with a slight ammonia odour



SYNONYMS

2-Aminoethanol, beta-Aminoethyl alcohol,
Ethanolamine, 2-Hydroxyethylamine

UN No. 2491

HEALTH HAZARDS

Hazardous by ingestion or inhalation.

Toxicity group I, TLV = 3 ppm

No data available for odour threshold.

Liquid or Solid

Irritating to skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Combustible.

Toxic and irritating vapours (nitrogen oxide, carbon monoxide) are produced when heated.

REACTIVITY

Sinks and mixes with water with no reaction. Corrosive to copper, copper alloys, galvanized iron and aluminum.

MONITORING METHODS

1. TAGA: detection limit is < 1 in 10^9 , (< 1 ppb).
2. Collection on midger impinger containing 0.1N sulphuric acid, hydrolysis and analysis by gas chromatography equipped with flame ionization detection.
(Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with liquid.

Wear goggles, self-contained breathing apparatus and protective clothing.

FIRST AID

CALL FOR MEDICAL AID.

Move to fresh air.

Contact

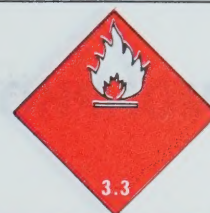
Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

MONOETHANOLAMINE

PHYSICAL PROPERTIES	S.G. 1.02 B.P. 170°C V.P. 6 mm (60°C) V.D. 2.1 F.Pt. 85°C (CC) Sol. miscible
MANUFAC- TURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131
NOTES	

MORPHOLINE

Colourless, oily liquid with a fishy, ammonia odour



SYNONYMS

Diethyleneimide oxide, Tetrahydro-2H-1,4-oxazine, Tetrahydro-p-oxazine

UN No.2054

HEALTH HAZARDS

Corrosive and absorbed by skin. Irritating to skin, eyes and mucous membranes.

Toxicity group I, IDLH = 8,000 ppm, TLV = 20 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes nausea, headache or difficult breathing.

Odour threshold = 0.01 ppm

Liquid

Irritating to skin and eyes.

FIRE HAZARDS

Flammable.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Toxic and irritating fumes of nitrogen oxides produced when heated.

Vapour is heavier than air.

REACTIVITY

Floats and mixes with water with no reaction.

Irritating vapour is produced.

MONITORING METHODS

1. Colorimetric detector tube for nitrogen oxides, e.g. Drager (0.6 to 1,250 mg/m³), Gastec (2.5 to 750 mg/m³), MSA (0 to 56 mg/m³).

Interferents: Ozone and chlorine react in the same way as nitrogen dioxide.

2. Adsorption on silica gel, desorption of morpholine with 0.05 M sulfuric acid and analysis by gas chromatography with flame ionization detection. A column (4 ft. long x 1/4 in. stainless steel) packed with 80/100 mesh chromosorb 103 is used. The range is 28.5 to 108.4 mg/m³ for a 20-litre sample. See method no. 36 (NIOSH S150).

3. Chemiluminescence may be used to detect nitrogen oxides, e.g. TECO, Monitor Labs, Bendix. Detection limit is < 5 ppb.

SAFETY MEASURES

Avoid contact with liquid and vapour. Wear goggles, and neoprene or butyl rubber gloves.

Equipment should have no copper, or copper alloy parts.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes with water and skin with plenty of water and soap.

Give conscious victim 3 glasses water-vinegar solution; INDUCE vomiting.

MORPHOLINE

SYNONYMS		
PHYSICAL PROPERTIES	S.G. 1.00 B.P. 128°C V.P. 7 mm V.D. 3.0 F.Pt. 35°C (CC) Sol. readily soluble	HEALTH HAZARDS
MANUFACTURERS	Not manufactured in Canada. Distributors: C.I.L., Toronto. Tel. (416)226-6110 Texaco Chemicals Canada Ltd., Toronto. Tel. (416)630-9322	
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

NAPHTHA (Coal Tar)

Colourless to pale yellow, watery liquid with a gasoline-like odour



SYNONYMS

Mixture of benzene, toluene and xylenes

UN No.2553

HEALTH HAZARDS

Toxicity group III, IDLH = 10,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes dizziness, headache, difficult breathing or loss of consciousness.

Odour threshold = 4.68 ppm

Liquid

Irritating to skin and eyes.

If swallowed, causes nausea or vomiting.

FIRE HAZARDS

Combustible.

Reacts with oxidizing materials.

Black smoke, toxic fumes and gases including oxides of carbon and nitrogen are produced when burning in air.

REACTIVITY

Floats on water with no reaction.

Produces an irritating vapour.

MONITORING METHODS

1. Adsorption on charcoal, desorption with carbon disulfide and analysis by a gas chromatograph equipped with a flame ionization detector. A column (6 ft. x 1/8 in. stainless steel) packed with 1.5% OV-101 on 100/120 mesh chromosorb W is used. The range is 193 to 809 mg/m³ for a 10-litre sample. See method no. 37 (NIOSH S86).

SAFETY MEASURES

Avoid contact with liquid or vapour.

Wear goggles, chemical-protective suit and respiratory equipment.

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

DO NOT induce vomiting.

NAPHTHA (Coal Tar)

PHYSICAL PROPERTIES	S.G. 0.86 to 0.88 B.P. 149 to 216°C V.P. < 5 mm V.D. 4.1 F.Pt. 38 to 43°C (CC) Sol. insoluble	HEALTH HAZARDS
MANUFACTURERS	Not manufactured in Canada. Distributors: Ashland Chemical/Solvents Division, Volvolin Oil & Chemicals, Toronto. Tel. (416) 823-1800	FIRE HAZARDS
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

NAPHTHALENE

Colourless, molten solid with mothball odour



SYNONYMS

Naphthaline, Tar camphor

UN No. 1334

HEALTH HAZARDS	Moderately toxic by ingestion, inhalation and skin absorption. Irritant. Toxicity group II, IDLH = 500 ppm, TLV = 10 ppm Odour threshold = 0.027 ppm <u>Solid or Liquid</u> Irritating to skin and eyes.
FIRE HAZARDS	Combustible. Vapours form explosive mixtures with air. Toxic vapours given off in fire. Dust can be explosive in air.
REACTIVITY	Solidifies and floats or sinks in water. Spatters and foams in contact with water with no chemical reaction.
MONITORING METHODS	1. TAGA: detection limit is < 1 in 10^6, (< 1 ppm). 2. Adsorption on charcoal, desorption with carbon disulfide and analysis by gas chromatography equipped with a flame ionization detector. The range is 19.3 to 83 mg/m³ using a 200-litre sample. See method no. 38 (NIOSH S292).
SAFETY MEASURES	Avoid contact with liquid and solid. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
FIRST AID	CALL FOR MEDICAL AID. Move to fresh air. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes and skin with plenty of water. If swallowed and victim is conscious, drink water. INDUCE vomiting.

NAPHTHALENE

NAPHTHALENE

Coloursless, volatile solid with mothball odour.

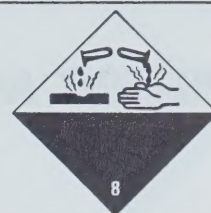
SYNONYMS Naphthalene, The carbide

UN No. 1234

PHYSICAL PROPERTIES	S.G. 1.15 B.P. 218°C V.P. 0.05 mm V.D. 4.4 F.Pt. 80°C (CC) Sol. insoluble	HEALTH HAZARDS
MANUFACTURERS	Not manufactured in Ontario. Record Chemical Co. Inc., Napierville, Que. Tel. (514) 341-3550 Syndel Laboratories Ltd., Vancouver, B.C. Tel. (604) 266-7131	
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

NITRIC ACID

Colourless to light brown, watery liquid with a choking odour



SYNONYMS

Aqua fortis, Azotic acid, Hydrogen nitrate

UN No. 2031

HEALTH HAZARDS

Corrosive to tissues. Highly toxic by ingestion, inhalation and skin absorption.

Toxicity group II, IDLH = 100 ppm, TLV = 2 ppm

Vapour

Will burn eyes, nose and throat.

If inhaled, causes difficult breathing or loss of consciousness.

No data available for odour threshold.

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Not flammable.

May cause fire on contact with combustibles.

Flammable gas formed on contact with metals.

Poisonous oxides of nitrogen and acid fumes produced when heated.

REACTIVITY

Sinks and mixes with water or steam producing heat and toxic and corrosive fumes.

Very corrosive to wood, paper, cloth and most metals.

MONITORING METHODS

1. Colorimetric detector tube for nitric acid, e.g. Drager (5 to 50 ppm), Gastec (2.58 to 46.4 mg/m³), MSA.

Interferents: nitrogen oxide is indicated with lower sensitivity.

2. Collection on 0.1M sodium chloride impregnated filters, followed by extraction and hydrazine reduction - diazotization analysis of nitrate. (Kamphake L, S. Hannah and J. Cohen, Water Res. 1 205 [1967]).
3. Collection on nylon or cotton, extraction and conversion to nitrobenzene, followed by analysis by gas chromatography with electron capture detection.
4. Chemiluminescence. Detection limit is < 1 in 10⁹, (< 1 ppb), e.g. TECO, Monitor Labs, Bendix.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear chemical-protective suit with self-contained breathing apparatus and rubber boots and gloves.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

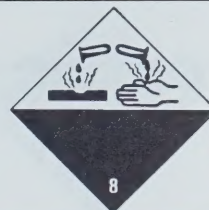
DO NOT induce vomiting.

NITRIC ACID

PHYSICAL PROPERTIES	S.G. 1.5 (25°C) B.P. 83°C V.P. 62 mm (25°C) V.D. no data available F.Pt. not flammable Sol. miscible in all proportions
MANUFAC- TURERS	C.I.L., Courtright. Tel. (519) 867-2739 C.I.L., Nobel. Tel. (705) 342-5213 Cyanamide of Canada Ltd., Niagara Falls. Tel. (416) 356-9000 Du Pont of Canada Ltd., North Bay. Tel. (705) 472-1300 Genstar Chemical Ltd., Maitland. Tel. (613) 348-3681
NOTES	

OXALIC ACID

White, solid crystals with no odour



SYNONYMS

Ethanedioic acid

UN No. N/A

HEALTH HAZARDS

Strong irritant. Highly toxic by ingestion or inhalation. Ingestion may prove fatal.

Toxicity group II, IDLH = 500 mg/m³, TLV = 1 mg/m³

Dust

Will burn eyes, nose and throat.

If inhaled, causes difficult breathing.

Odour threshold not pertinent.

Solid

Will burn skin and eyes.

If swallowed, causes nausea or loss of consciousness.

FIRE HAZARDS

Not flammable.

Poisonous gases are produced in fire.

REACTIVITY

Sinks and mixes slowly with water with no reaction.

MONITORING METHODS

1. Collection on glass fiber filter, extraction in deionized water and analysis by ion chromatography. (Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with solid and dust.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; DO NOT induce vomiting.

OXALIC ACID

PHYSICAL PROPERTIES	S.G. 1.9 (15°C) B.P. sublimes at 150°C V.P. < 0.001 mm V.D. not pertinent F.Pt. not flammable Sol. 8.34 g/100 ml
MANUFACTURERS	Not manufactured in Ontario. Anachemia Ltd., Ville St. Pierre, Que. Tel. (514) 489-5711
NOTES	

PARAFORMALDEHYDE

White, solid powder with an irritating odour



SYNONYMS

Formaldehyde polymer, Paraform, Polyformaldehyde, Polyoxymethylene, Trioxymethylene

UN No. 2213

HEALTH HAZARDS

Highly toxic by ingestion. Moderately toxic by inhalation.
Toxicity group II, TLV = 5 ppm
Dust
Irritating to eyes, nose and throat.
Harmful if inhaled.
No data available for odour threshold.

FIRE HAZARDS

Combustible.
Vapour or dust may form explosive mixtures with air.
Releases flammable and toxic formaldehyde vapours.
When heated, forms formaldehyde gas and oxides of carbon.

REACTIVITY

Sinks and mixes with water forming water solution of formaldehyde.

MONITORING METHODS

1. Colorimetric detector tube for formaldehyde, e.g. Drager (0.6l to 50.0 mg/m³), Gastec (2.5 to 25 mg/m³), MSA (1.25 to 125 mg/m³).
2. Collection on oxidizer impregnated charcoal, extraction with 0.1% peroxide for 1 hour and analysis by ion chromatography. Nominal detection limit in 20 mls of solution is 0.05 mg/l. Lower detection limits are attainable by modifying the system. See method no. 27.
3. Collection in midget fritted glass bubbler containing 10% methanol solution and analysis by polarography. (Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with solid and dust.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.
Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.
Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink milk or white of egg beaten with water.

PARAFORMALDEHYDE

PARAFORMALDEHYDE

White, solid powder with an irritating odor.

SYNONYMS

PHYSICAL PROPERTIES	S.G. 1.46 (15°C) B.P. decomposes at 1 atm V.P. 5.0 mm in dry air (60°C) V.D. no data available F.Pt. 71°C (CC) Sol. slightly soluble	HEALTH HAZARDS
MANUFACTURERS	Not manufactured in Canada. Distributor: Celanese Canada Inc., Mississauga.	HAZARDS
NOTES		REACTIVITY
		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

PENTACHLOROPHENOL

White to light brown solid beads or flakes with a faint odour



SYNONYMS

Dowicide 7, Penta, Santophen 20, PCP

UN No.2020

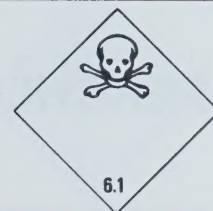
HEALTH HAZARDS	Strong irritant. Highly toxic by all routes. Toxicity group I, IDLH = 150 mg/m³, TLV = 0.5 mg/m³ <u>Dust</u> Irritating to eyes, nose and throat. If inhaled causes coughing or difficult breathing. Odour threshold = 0.86 to 12.0 mg/l <u>Solid</u> Poisonous if inhaled. Will burn skin and eyes.
FIRE HAZARDS	Not flammable. Toxic and irritating chloride vapours generated when heated to decomposition.
REACTIVITY	Sinks in water with no reaction.
MONITORING METHODS	1. A known volume of air is drawn through a mixed cellulose ester membrane filter connected in series to a midget impinger containing 15 ml of ethylene glycol. The resulting sample is analyzed by high pressure liquid chromatography using a UV detector set at 254 nm. The range is 0.265 to 1.130 mg/m³ for a 180-litre sample. See method no. 39 (NIOSH S297).
SAFETY MEASURES	Avoid contact with dust and solid. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves). Stay upwind.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes with water and skin with plenty of water and soap. If swallowed and victim is conscious, drink water or milk; INDUCE vomiting immediately.

PENTACHLOROPHENOL

PHYSICAL PROPERTIES	S.G. 1.98 (22°C) B.P. decomposes at 310°C V.P. 0.0002 mm V.D. 9.2 F.Pt. not flammable Sol. 0.005 g/100 ml (0°C)
MANUFAC- TURERS	Not manufactured in Ontario. Uniroyal Chemical, Division of Uniroyal Ltd., Sherwood Park, Alta. Tel. (403)467-5551
NOTES	

PERCHLOROETHYLENE

Colourless, watery liquid with a sweet odour



SYNONYMS

Perclene, Tetracap, Tetrachloroethylene,
Ethylene tetrachloride

UN No. 1897

HEALTH HAZARDS

Highly toxic by ingestion and inhalation. Acts as an anesthetic. Moderately toxic through skin absorption.

Toxicity group II, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled causes difficult breathing, or loss of consciousness.

Odour threshold = 5 ppm

Liquid

Irritating to skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Not flammable.

Toxic and irritating gases of hydrogen chloride and phosgene are produced when heated.

REACTIVITY

Sinks in water with no reaction.

Produces irritating vapour.

MONITORING METHODS

1. Colorimetric detector tube for perchloroethylene, e.g. Drager (30 to 96,600 mg/m³), Gastec (30 to 1,400 mg/m³), MSA (69 to 2,760 mg/m³).

Interferents: Free halogens, hydrogen halides and easily cleaved halogenated hydrocarbons give a similar indication to perchloroethylene.

2. Adsorption on a charcoal tube, desorption with carbon disulphide and analysis by a gas chromatograph equipped with a flame ionization detector or an electron capture detection. A column (10 ft. x 1/8 in. stainless steel) packed with 10% OV-101 stationary phase on 100/120 mesh Supelcoport. The range of measurement is 655-2749 mg/m³ for a 3-litre sample. See method no. 14 (NIOSH S335).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear chemical-protective clothing, self-contained breathing apparatus and PVA or PVC coated gloves.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink salted water;

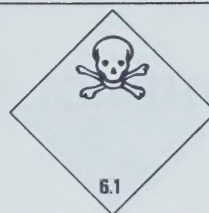
INDUCE vomiting.

PERCHLOROETHYLENE

PHYSICAL PROPERTIES	S.G. 1.63 B.P. 121°C V.P. 16 mm (22°C) V.D. 5.83 F.Pt. not flammable Sol. 0.02 g/100 ml (25°C)
MANUFAC- TURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519) 339-3131
NOTES	

PHENOL

White solid crystals, or light pink, watery liquid with a sweet tarry odour



SYNONYMS

Carbolic acid, Hydroxybenzene

UN No. 1671

HEALTH HAZARDS

Poisonous. Causes severe tissue burns. Lethal amounts may be ingested, inhaled or readily absorbed by skin.

Toxicity group II, IDLH = 100 ppm, TLV = 5 ppm

Odour threshold = 0.05

Liquid or Solid

Poisonous if swallowed.

Will burn skin and eyes.

FIRE HAZARDS

Combustible.

Toxic and irritating flammable vapours generated when heated, forming explosive mixtures with air.

Poisonous gases produced in fire.

REACTIVITY

Floats or sinks, and mixes slowly with water, with no reaction. Fumes may react with oxidizing materials.

MONITORING METHODS

1. Colorimetric detector tube for phenol, e.g. Drager (19 mg/m^3).

Interferents: Cresols and xylenols also give a positive test.

2. A known volume of air is drawn through a midjet impinger containing 15 ml of 0.1N sodium hydroxide as the collection medium. The resulting solution is acidified with sulphuric acid. An aliquot of the collected sample is injected into a gas chromatograph equipped with a flame ionization detector. The range is 9.46 to 37.8 mg/m^3 . See method no. 40 (NIOSH S330).

SAFETY MEASURES

Avoid contact with liquid and solid.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

DO NOT induce vomiting.

PHENOL

PHYSICAL PROPERTIES	S.G. 1.06 for liquid (41°C) B.P. 182°C V.P. 0.2 mm V.D. 3.2 F.Pt. 79.4°C (CC) Sol. 8.2 g/100 ml (15°C)
MANUFAC- TURERS	Not manufactured in Ontario. Gulf Canada Ltd., Chemicals Division, Montreal. Tel. (514) 284-5111
NOTES	

PHOSPHORIC ACID

Colourless, thick liquid with no odour



SYNONYMS

Orthophosphoric acid

UN No.1805

HEALTH HAZARDS

Toxicity group I, TLV = 1.0 mg/m³

Odour threshold not pertinent.

Liquid

Will burn skin and eyes.

If swallowed causes nausea, vomiting or loss of consciousness.

FIRE HAZARDS

Not flammable.

Flammable hydrogen gas is formed on contact with metals.

REACTIVITY

Sinks and mixes with water, with mild evolution of heat.

MONITORING METHODS

1. Collection on a membrane filter, extraction with water followed by spectrophotometric analysis by the molybdenum blue method at 830 nm. The range is 0.47 to 1.93 mg/m³ in a 50-litre sample of air. See method no. 41 (P & CAM 216).

SAFETY MEASURES

Avoid contact with liquid.

Wear chemical-protective suit with self-contained breathing apparatus and rubber gloves.

FIRST AID

CALL FOR MEDICAL AID.

Move to fresh air.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

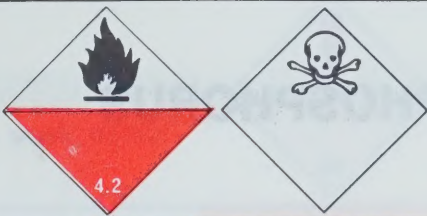
DO NOT induce vomiting.

PHOSPHORIC ACID

PHYSICAL PROPERTIES	S.G. 1.89 (25°C) B.P. > 130°C V.P. 0.03 mm V.D. not pertinent F.Pt. not flammable Sol. 548 g/100 ml
MANUFACTURERS	C.I.L., Courtright. Tel. (519) 356-9000 Erco Industries Ltd., Port Maitland. Tel. (416) 774-7476 International Minerals & Chemicals Corp. (Canada) Ltd., Port Maitland. Tel. (416) 774-7681
NOTES	

PHOSPHORUS

Light yellow waxy solid with a garlic-like odour



SYNONYMS

Elemental phosphorus, Yellow phosphorus, White phosphorus

UN No.1381

HEALTH HAZARDS

Vapours of burning phosphorus may cause severe injury or death.

Toxicity group I, TLV = 0.1 mg/m³

No data available for odour threshold.

Solid

Will burn skin and eyes.

If swallowed, causes nausea, vomiting or loss of consciousness.

FIRE HAZARDS

Highly flammable.

May ignite on contact with air.

Poisonous and irritating gases of oxides of phosphorus are produced in fire - forms intense white smoke.

REACTIVITY

Sinks in water with no reaction.

Fumes and burns in air.

Reacts vigorously with oxidizing materials.

MONITORING METHODS

1. Collection on 35/60 mesh Tenax-GC resin, extraction with xylene and analysis by gas chromatography and flame photometric detection specific for phosphorus. The range is 0.056 to 0.244 mg/m³ using a 12-litre sample. See method no. 42 (NIOSH S334 or P & CAM 242).

SAFETY MEASURES

Avoid contact with solid.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk; INDUCE vomiting.

PHOSPHORUS

PHYSICAL PROPERTIES	S.G. 1.82 B.P. 280°C V.P. 0.03 mm V.D. 4.4 F.Pt. > 30°C (CC) Sol. insoluble	HEALTH HAZARDS
MANUFACTURERS	Erco Industries Ltd., Toronto. Tel. (416) 239-7111	THE FIRE HAZARDS
NOTES		WORKING METHODS SAFETY MEASURES FIRST AID

POLYCHLORINATED BIPHENYL

Light yellow, oily liquid to white solid powder with a weak odour



SYNONYMS

Aroclor, Chlorinated biphenyl, PCB, Askarel

UN No.2315

HEALTH HAZARDS

Strong irritant. Persistent and bioaccumulative.

Toxicity group II, TLV = 0.5 to 1.0 mg/m³

No data available for odour threshold.

Liquid or Solid

Irritating to skin and eyes.

Causes liver damage and skin changes.

FIRE HAZARDS

Combustible.

Irritating gases generated in fires.

REACTIVITY

Sinks in water with no reaction.

MONITORING METHODS

1. Collection on sorbent tube containing Florisil, desorption in hexane and analysis by gas chromatography with electron capture detection. The range is 0.01 to 10 mg/m³ using a 48-litre sample. See method no. 43 (NIOSH 244 or P & CAM 244).

SAFETY MEASURES

Avoid contact with liquid and solid.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

Contact

Remove contaminated clothing and shoes promptly.

Flush eyes with water for 15 minutes.

Clean exposed skin with waterless cleaner, wipe; then wash with soap and water.

If swallowed, INDUCE vomiting.

POLYCHLORINATED BIPHENYL

PHYSICAL PROPERTIES	S.G. 1.3 to 1.8 for liquid B.P. 340 to 375°C V.P. < 1 mm (150°C) V.D. not pertinent F.Pt. > 141°C Sol. 0.01 ppm (25°C)	HEALTH HAZARDS
MANUFACTURERS	Not manufactured or distributed in Canada, since 1979.	FIRE HAZARDS
NOTES		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

n-PROPYL ALCOHOL

Colourless liquid with an alcohol odour



SYNONYMS

Ethyl carbinol, 1-Propanol, Propyl alcohol

UN No.1274

HEALTH HAZARDS

Toxicity group III, IDLH = 4,000 ppm, TLV = 200 ppm

Vapour
Irritating to eyes, nose and throat.
If inhaled, causes nausea, dizziness or headache.

Odour threshold = 30 ppm

Liquid
Will burn eyes.
Harmful if swallowed.

FIRE HAZARDS

Flammable.
Flashback along vapour trail may occur.
Vapour may explode if ignited in an enclosed area.
Vapour is heavier than air.

REACTIVITY

Mixes with water with no reaction.
Produces flammable and irritating vapour.

MONITORING METHODS

1. Colorimetric detector tube for alcohol, e.g. Drager (100 to 3,000 ppm), Gastec, MSA.
- Interferents: Ethanol, methanol and butanol react with same sensitivity.
2. Adsorption on charcoal, desorption with carbon disulfide containing 1% 2 - propanol and analysis by a gas chromatograph equipped with a flame ionization detector. A column (10 ft. x 1/8 in. stainless steel) packed with 10% FFAP on 80/100 Chromosorb W-AW is used. The range of measurement is 225 to 835 mg/m³ for a 10-litre sample size. See method no. 44 (NIOSH S62).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact
Remove contaminated clothing and shoes.
Flush eyes and skin with plenty of water.
If swallowed and victim is conscious, drink water;
INDUCE vomiting.

n-PROPYL ALCOHOL

PHYSICAL PROPERTIES	S.G. 0.80 B.P. 97°C V.P. 15 mm V.D. 2.07 F.Pt. 25°C (CC) Sol. miscible in all proportions	HEALTH HAZARDS
MANUFACTURERS	Caledon Laboratories Ltd., Georgetown. Tel. (416) 877-0101	FIRE HAZARDS
NOTES		REACTIVITY
		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

PROPYLENE OXIDE

Colourless liquid with a sweet, alcohol odour



SYNONYMS

1,2-Epoxypropane, Methyloxirane,
Propeneoxide

UN No.1280

HEALTH HAZARDS

Moderately hazardous by all routes.

Toxicity group III, IDLH = 2,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled causes nausea, vomiting, headache or loss of consciousness.

Odour threshold = 200 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Flammable.

Containers may explode in fire.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Vapour is heavier than air.

REACTIVITY

Mixes with water with no reaction.

Produces a flammable, irritating vapour.

Polymerization may occur at high temperatures.

MONITORING METHODS

1. Colorimetric detector tube for propylene oxide, e.g. Gastec (7,120 to 85,400 mg/m³).
2. Adsorption on charcoal, desorption with carbon disulfide and analysis by gas chromatography equipped with a flame ionization detector. The range is 121 to 482 mg/m³ for a 5-litre sample. See method no. 45 (NIOSH S75).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk.

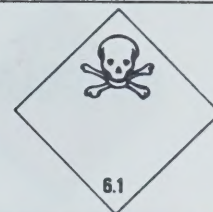
INDUCE vomiting.

PROPYLENE OXIDE

SYNONYMS		UN 1011	
1,2-Epoxypropylene, Propylene oxide		1,2-Epoxypropylene, Propylene oxide	
PHYSICAL PROPERTIES	S.G. 0.83 B.P. 34°C V.P. 442 mm V.D. 2.0 F.Pt. -37.5°C (CC) Sol. 40.5 g/100 ml	HEALTH HAZARDS	
	MANUFACTURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131	
NOTES	MONITORING METHODS	SAFETY MEASURES	
	FIRST AID	FIRST AID	

SODIUM CYANIDE

White solid granules, flakes or lumps with an almond odour



SYNONYMS

Hydrocyanic acid, sodium salt,
Cyanogran, White cyanide

UN No. 1689

HEALTH HAZARDS

Highly poisonous.
Toxicity group I, TLV = 0.5 ppm
Dust
Poisonous if inhaled or if skin is exposed.
Odour threshold not available.
Solid
Poisonous if swallowed or if skin is exposed.
Severe skin irritant, causing second degree burns.
Will burn eyes.

FIRE HAZARDS

Not flammable.
Releases highly hazardous cyanides when heated to decomposition or on contact with acid or acid fumes.

REACTIVITY

Sinks and mixes with water forming poisonous hydrogen cyanide gas.

MONITORING METHODS

1. Collected on cellulose membrane filter in series with a midjet impinger containing sodium hydroxide solution. Analysis of extract and impinger liquid separately by cyanide ion specific electrode. Using a 90-litre sample the validated range is 2.6 - 9.7 mg/m³ with 0.5 - 15 mg/m³ believed to provide a linear response. See method no. 46 (NIOSH S250).

Interferents: Gaseous hydrogen cyanide and other particulate cyanides will interfere.

SAFETY MEASURES

Avoid contact with solid, dust and solution.
Wear chemical-protective suit with self-contained breathing apparatus, including gloves (cotton for dry product, rubber for solutions).

FIRST AID

CALL FOR MEDICAL AID,
Inhalation
Move to fresh air.
If breathing has stopped, give artificial respiration; if laboured, give oxygen.
Contact
Remove contaminated clothing and shoes.
Flush eyes and affected areas with plenty of water.
If swallowed and victim is conscious, drink water or milk;
INDUCE vomiting.

SODIUM CYANIDE

PHYSICAL PROPERTIES

S.G. 1.06
B.P. very high
V.P. not pertinent
V.D. not pertinent
F.Pt. not flammable
Sol. 34.2 g/100 ml (25°C)

MANUFAC- TURERS

Park Thermal Ltd., Georgetown. Tel. (416) 877-5254

NOTES

STYRENE

Colourless to light yellow, watery liquid with a sweet pleasant odour



SYNONYMS

Phenylethylene, Styrol, Vinylbenzene

UN No. 2055

HEALTH HAZARDS

Severe eye injuries. Respiratory irritant. Moderately toxic by ingestion or inhalation.

Toxicity group III, IDLH = 5,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled causes dizziness or loss of consciousness.

Odour threshold = 0.15 ppm

Liquid

Will burn skin and eyes.

Harmful if swallowed.

FIRE HAZARDS

Flammable.

Containers may explode in fire.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Vapour is heavier than air.

REACTIVITY

Floats on water with no reaction; produces a flammable irritating vapour. Corrodes copper and its alloys. Polymerization occurs if heated above 66°C or exposed to heat, light or catalytic materials.

MONITORING METHODS

1. Colorimetric detector tube, e.g. Drager (213 to 1700 mg/m³), Gastec (43.5 to 4,350 mg/m³), MSA (4.35 to 3,920 mg/m³).

Interferents: a few organic compounds which tend towards polymerization, react similarly.

2. Adsorption on charcoal, desorption with carbon disulfide and analysis by a gas chromatograph equipped with a flame ionization detector. A column (10 ft. x 1.8 in. stainless steel) packed with 10% FFAP on 80/100 mesh, acid washed DMCS Chromosorb W is used. The range of measurement is 426 to 1710 mg/m³ for a 5-litre sample size. See method no. 46 (NIOSH S30).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus, chemical-protective suit and rubber gloves.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

DO NOT induce vomiting.

STYRENE

STYRENE

Colourless to light yellow, watery liquid with a sweet pleasant odour

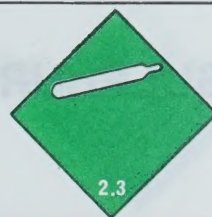
Phenylacetylene, Styrol, Vinylbenzene

SYNONYMS

PHYSICAL PROPERTIES	S.G. 0.91 (25°C) B.P. 145°C V.P. 5 mm V.D. 3.6 F.Pt. 31°C (CC) Sol. 0.03 g/100 ml	HEALTH HAZARDS
MANUFACTURERS	Dow Chemical of Canada Ltd., Sarnia. Polysar Ltd., Sarnia.	Tel. (519) 339-3131 Tel. (519) 337-8251
NOTES	1. Characteristic heat of vaporization 41.5 kJ/mol (10,000 cal/mol). 2. Flashback along vapour trail in an enclosed area. Vapour may explode if ignited in an enclosed area. Vapour is heavier than air. 3. Flammable on water with no reaction; produces a flame on contact with water. Contact with water produces a flame. Contact with water produces a flame. Contact with water produces a flame.	REACTIVITY MONITORING METHODS SAFETY MEASURES FIRST AID

SULPHUR DIOXIDE

Colourless, liquefied compressed gas with a sharp, irritating odour



SYNONYMS

Sulphurous acid anhydride

UN No.1079

HEALTH HAZARDS

Highly toxic. Dangerous to the eyes and respiratory tract. Corrosive and poisonous. Excessive exposure can be fatal.

Toxicity group II, IDLH = 100 ppm, TLV = 2 ppm

Vapour

Poisonous if inhaled.

Odour threshold = 3 ppm

Liquid

Causes frostbite and severe skin and eye burns.

FIRE HAZARDS

Not flammable.

Containers may rupture and release toxic and irritating sulphur dioxide.

REACTIVITY

Liquid sinks, with slight solubility, and boils producing sulphurous acid, which is corrosive to most metals.

Poisonous, visible vapour cloud is produced.

MONITORING METHODS

1. Colorimetric detector tube for sulphur dioxide, e.g. Drager (2.62 to 1310 mg/m³), Gastec (2.62 to 209,000 mg/m³), MSA (2.62 to 1,048 mg/m³).

Interferents: hydrogen chloride is also indicated.

2. Sulphur dioxide is absorbed from air in a solution of potassium tetrachloro mercurate (TCM). A dichlorosulphitomercurate complex is formed which resists oxidation by air. The complex is then reacted with pararosaniline and formaldehyde to form pararosaniline sulphonic acid. The absorbance of the solution is measured spectrophotometrically.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus, gas-tight suit and rubber gloves.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water. Do not rub affected areas.

If swallowed and victim is conscious, drink milk or water.

DO NOT induce vomiting.

SULPHUR DIOXIDE

PHYSICAL PROPERTIES	S.G. 1.45 for liquid (-10°C) B.P. -10°C V.P. 2538 mm (21°C) V.D. 2.3 F.Pt. not flammable Sol. 11.7 g/100 ml (15.5°C)	HEALTH HAZARDS
MANUFACTURERS	INCO, (formally C.I.L.), Copper Cliff.	Tel. (705)682-2881
NOTES		REACTIVITY
		MONITORING METHODS
		SAFETY MEASURES
		FIRST AID

SULPHUR MONOCHLORIDE

Yellow to red, oily liquid with an irritating, sharp odour



SYNONYMS

Sulphur chloride, Sulphur subchloride

UN No.1828

HEALTH HAZARDS

Highly irritating fumes.

Toxicity group I, IDLH = 10 ppm, TLV = 1 ppm

Vapour

Irritating to eyes.

Poisonous if inhaled.

No data available for odour threshold.

Liquid

Will burn skin and eyes.

Poisonous if swallowed.

FIRE HAZARDS

Combustible.

Toxic and corrosive fumes of chlorides and oxides of sulphur are produced when heated.

REACTIVITY

Mixes and reacts violently with water, evolving heat and hydrogen chloride fumes. Acid solution attacks metals, generating flammable gas. Dissolves rubber and plastics.

MONITORING METHODS

1. Colorimetric detector tube for hydrogen chloride, e.g. Drager (1.5 to 30.4 mg/m³), Gastec (0.3 to 61 mg/m³), MSA (3.04 to 760 mg/m³).
2. Midget impinger collection in 0.5M sodium acetate and analysis using a chloride ion specific electrode. See method no. 29 (NIOSH S246).
3. Collection on impregnated sodium carbonate W41 filter, extraction in deionized water and analysis by ion chromatography.
(Suggested method only, proven sampling method not available.)

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water or milk;

DO NOT induce vomiting.

SULPHUR MONOCHLORIDE

PHYSICAL PROPERTIES	S.G. 1.68 B.P. 135.6°C V.P. 7.0 mm V.D. no data available F.Pt. 118°C (CC) Sol. decomposes
MANUFAC- TURERS	Not manufactured in Canada. Distributor: Canada Colours and Chemicals Ltd., Toronto. Tel: (416)924-6831
NOTES	

SULPHURIC ACID

Colourless, oily liquid with a sharp, penetrating odour



SYNONYMS

Battery acid, Fertilizer acid, Oil of Vitriol
Hydrogen sulphate, Sulphuric acid spent

UN No. 1830

HEALTH HAZARDS

Contact with body results in rapid destruction of tissues, causing severe burns.

Toxicity group II, IDLH = 80 mg/m³, TLV = 1 mg/m³

Mist

Irritating to eyes, nose and throat.

If inhaled causes coughing, difficult breathing or loss of consciousness.

Odour threshold = > 1 mg/m³

Liquid

Will burn skin and eyes. Harmful if swallowed.

FIRE HAZARDS

Not flammable.

May cause fire on contact with combustibles.

Flammable gas produced on contact with metals.

Poisonous gas produced in fire.

REACTIVITY

Sinks and mixes violently with water, evolving heat.

Boils and spatters when water is added. Contact with metals is extremely hazardous, evolving flammable and explosive hydrogen gas.

MONITORING METHODS

1. Collection on teflon filter, extraction with deionized water, followed by analysis for sulphate by MTB, IC or turbidimetry.
2. Collection on cellulose membrane filter and extraction with distilled water and isopropyl alcohol. The pH of the solution is adjusted to a value between 2.5 and 4.0 with dilute perchloric acid. The resulting solution is titrated with barium perchlorate using Thorin as indicator. The range is 0.561 to 2.577 mg/m³ for 180-litre sample. See method no. 47 (NIOSH S174).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus, acid suit (rubber) and rubber gloves and boots.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes, (while under shower).

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink milk;

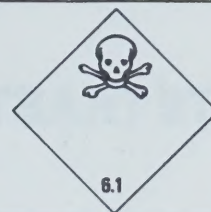
DO NOT induce vomiting.

SULPHURIC ACID

PHYSICAL PROPERTIES	S.G. 1.84 B.P. 340°C V.P. < 0.001 mm V.D. not pertinent F.Pt. not flammable Sol. completely miscible																		
MANUFAC- TURERS	<table> <tr> <td>C.I.L., Courtright.</td><td>Tel. (519)867-2739</td></tr> <tr> <td>C.I.L., Nobel.</td><td>Tel. (705)342-5236</td></tr> <tr> <td>Cyanamid of Canada Ltd., Niagara Falls.</td><td>Tel. (416)356-9000</td></tr> <tr> <td>Du Pont of Canada Ltd., North Bay.</td><td>Tel. (705)472-1300</td></tr> <tr> <td>Falconbridge Nickel Mines Ltd., Sudbury.</td><td>Tel. (705)693-2761</td></tr> <tr> <td>INCO (formally C.I.L.), Copper Cliff.</td><td>Tel. (705)682-2881</td></tr> <tr> <td>International Minerals and Chemicals Corp. Canada Ltd., Port Maitland.</td><td>Tel. (416)744-7681</td></tr> <tr> <td>Sulco Chemicals Ltd., Elmira.</td><td>Tel. (519)669-5166</td></tr> <tr> <td>Texasgulf Inc. Metals Division, Timmins.</td><td>Tel. (705)235-8121</td></tr> </table>	C.I.L., Courtright.	Tel. (519)867-2739	C.I.L., Nobel.	Tel. (705)342-5236	Cyanamid of Canada Ltd., Niagara Falls.	Tel. (416)356-9000	Du Pont of Canada Ltd., North Bay.	Tel. (705)472-1300	Falconbridge Nickel Mines Ltd., Sudbury.	Tel. (705)693-2761	INCO (formally C.I.L.), Copper Cliff.	Tel. (705)682-2881	International Minerals and Chemicals Corp. Canada Ltd., Port Maitland.	Tel. (416)744-7681	Sulco Chemicals Ltd., Elmira.	Tel. (519)669-5166	Texasgulf Inc. Metals Division, Timmins.	Tel. (705)235-8121
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NOTES																			

TETRAETHYL LEAD

Oily liquid, colourless but generally dyed red, with a fruity odour



SYNONYMS

TEL, Lead tetraethyl

UN No. 1649

HEALTH HAZARDS

Highly toxic by ingestion, inhalation and skin absorption.
Toxicity group I, IDLH = 3 ppm, TLV = 0.1 mg/m³

Vapour

Poisonous if inhaled or if skin is exposed.

Irritating to eyes.

No data available for odour threshold.

Liquid

Poisonous if inhaled or if skin is exposed.

Will burn eyes.

FIRE HAZARDS

Combustible.

Poisonous gases are produced in a fire.

Container may explode in fire.

Vapour may explode if ignited in enclosed area.

REACTIVITY

Sinks in water with no reaction.

Rust and some metals cause decomposition.

MONITORING METHODS

1. Adsorption on XAD-2, desorption with pentane and analysis by gas chromatography with a photoionization detector. A column (10 ft. x 1/8 in. stainless steel) packed with 5% carbowax 20M stationary phase on 80/100 mesh. Chromosorb WAW is used. The range is 0.045 to 0.020 mg/m³. See method no. 48a (NIOSH S383).
2. Collection of air sample on glass fibre iodized carbon filter, extraction with iodine solution followed by a colorimetric determination as lead dithiozonate using a commercially available test kit. See method no. 48b.
3. Collection of air sample as in (2), and extraction with nitric acid - bromine reagent, followed by atomic absorption spectrophotometry with electrothermal atomization. See method no. 48c.

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured give oxygen.

Contact

Remove contaminated clothing and shoes.

Immediately flush skin and eyes with plenty of water.

If swallowed and if victim is conscious, drink water. INDUCE vomiting.

TETRAETHYL LEAD

PHYSICAL PROPERTIES	S.G. 1.6 B.P. decomposes at 198 to 202°C V.P. 0.2 mm V.D. 7 F.Pt. 93°C (CC) Sol. slightly soluble
MANUFACTURERS	Dupont of Canada Limited, Maitland. Tel. (613) 348-3611 Ethyl Corporation of Canada Limited, Corunna. Tel. (519) 862-1411
NOTES	

TETRAMETHYL LEAD

Colourless, oily liquid with a fruity odour



SYNONYMS Lead tetramethyl, TML

UN No.1649

HEALTH HAZARDS	Powerful poison. Highly toxic by all routes. Toxicity group I, IDLH = 40 mg/m³, TLV = 0.15 mg/m³ <u>Vapour</u> Poisonous if inhaled. Irritating to eyes. No data available for odour threshold. <u>Liquid</u> Poisonous if swallowed or if skin is exposed. Will burn eyes.
FIRE HAZARDS	Combustible. Containers may explode in fire. Vapour may explode if ignited in an enclosed area. Highly toxic fumes of lead produced in fire. Reacts vigorously with oxidizing materials.
REACTIVITY	Sinks in water with no reaction. Produces a poisonous, flammable vapour.
MONITORING METHODS	1. Adsorption on XAD-2, desorption with pentane and analysis by gas chromatography with a photoionization detector. A column (10 ft. x 1/8 in. stainless steel) packed with 5% carbowax 20M stationary phase on 80/100 mesh chromosorb WAW is used. The range is 0.045 to 0.020 mg/m³. See method no. 48a (NIOSH S383). 2. Collection of air sample on a glass fibre iodized carbon filter, extraction with iodine solution followed by a colorimetric determination as lead dithiozonate using a commercially available test kit. See method no. 48b. 3. Collection of air sample as in 2, and extraction with nitric acid - bromine reagent, followed by atomic absorption spectrophotometry with electrothermal atomization. See method no. 48c.
SAFETY MEASURES	Avoid contact with liquid and vapour. Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves). Stay upwind.
FIRST AID	CALL FOR MEDICAL AID. <u>Inhalation</u> Move to fresh air. If breathing has stopped, give artificial respiration; if laboured, give oxygen. <u>Contact</u> Remove contaminated clothing and shoes. Flush eyes with water and wash skin with kerosene followed by soapy water. If swallowed and victim is conscious, drink water or milk. INDUCE vomiting.

TETRAMETHYL LEAD

PHYSICAL PROPERTIES	S.G. 1.99 B.P. 110°C V.P. 22 mm V.D. 6.5 F.Pt. 38°C (CC) Sol. no data available
MANUFAC- TURERS	Du Pont of Canada Ltd., Maitland. Ethyl Canada Inc., Corunna. Tel. (613)824-9222 Tel. (519)862-1411
NOTES	

TITANIUM TETRACHLORIDE

Colourless to light yellow, watery liquid with an irritating odour



SYNONYMS

Titanic chloride

UN No.1838

HEALTH HAZARDS

Highly toxic. Irritates skin, eyes and respiratory tract.

Toxicity group I, TLV = 5 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes coughing or headache.

No data available for odour threshold.

Liquid

Will burn skin and eyes.

If swallowed, causes nausea and vomiting.

FIRE HAZARDS

Not flammable.

REACTIVITY

Reacts violently with water and with moisture in air liberating heat and dense white fumes of corrosive hydrochloric acid.

Attacks metals forming flammable hydrogen gas.

MONITORING METHODS

1. Colorimetric detector tube for hydrogen chloride, e.g. Drager (1.5 to 30.4 mg/m³), Gastec (0.3 to 61 mg/m³), MSA (3.04 to 760 mg/m³).
2. Collection of titanium dioxide on mixed cellulose ester filter, (0.8 µm), wet ashing using nitric acid followed by heating with sulphuric acid and ammonium sulphate. Samples are analyzed by atomic absorption using a nitrous oxide-acetylene flame. A hollow cathode lamp for titanium is used to provide a characteristic titanium line at 364.3 nm. The range is 8.1 to 29.5 mg/m³. See method no. 49 (NIOSH S385).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Equipment should be acid resistant.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes with water; wipe skin with dry clothing, then water.

If swallowed and victim is conscious, drink water or milk;

INDUCE vomiting.

TITANIUM TETRACHLORIDE

PHYSICAL PROPERTIES	S.G. 1.73 B.P. 136°C V.P. 10 mm (21°C) V.D. no data available F.Pt. not flammable Sol. miscible
MANUFAC- TURERS	Not manufactured in Canada Distributor: Kingsley & Keith (Canada) Ltd., Toronto. Tel. (416) 626-8383
NOTES	

TOLUENE

Colourless, watery liquid with a pleasant odour



SYNONYMS

Methylbenzol, Methylbenzene,
Phenylmethane, Toluol

UN No.1294

HEALTH HAZARDS

Narcotic in high concentrations. Hazardous by all exposure routes.

Toxicity group III, IDLH = 2,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled causes nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.

Odour threshold = 0.17 ppm

Liquid

Irritating to skin and eyes.

If swallowed, causes nausea, vomiting or loss of consciousness.

FIRE HAZARDS

Flammable.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Vapour is heavier than air.

When heated, emits toxic fumes.

REACTIVITY

Floats on water with no reaction.

Produces a flammable, irritating vapour.

MONITORING METHODS

1. Colorimetric detector tube for toluene, e.g. Drager (19.2 to 7,142 mg/m³), Gastec (38.4 to 32,640 mg/m³), MSA (38.4 to 3,072 mg/m³).

Interferents: Xylenes also give a positive test but with lower sensitivity.

2. Adsorption on charcoal, desorption with carbon disulfide and analysis by gas chromatography with flame ionization detection. Nominal detection limit is 0.01 mg/sample for a minimum sample volume of 0.5-litres and a maximum of 22-litres. See method no. 14 (P & CAM 127).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

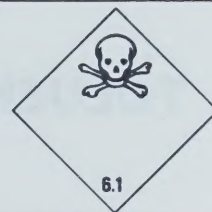
If swallowed and victim is conscious, give mineral oil, then drink water; DO NOT induce vomiting.

TOLUENE

PHYSICAL PROPERTIES	S.G. 0.87 B.P. 111°C V.P. 22 mm V.D. 3.1 F.Pt. 4°C (CC) Sol. 0.05 g/100 ml										
MANUFAC- TURERS	<table> <tr> <td>Esso Chemical Canada, Sarnia.</td><td>Tel. (519) 339-2000</td></tr> <tr> <td>Petrosar Ltd., Corunna</td><td>Tel. (519) 332-0220</td></tr> <tr> <td>Shell Canada Ltd., Corunna.</td><td>Tel. (519) 862-1491</td></tr> <tr> <td>Sunchem, Division of Sunoco Inc., Sarnia.</td><td>Tel. (519) 337-2301</td></tr> <tr> <td>Texaco Canada Ltd., Mississauga.</td><td>Tel. (416) 278-5511</td></tr> </table>	Esso Chemical Canada, Sarnia.	Tel. (519) 339-2000	Petrosar Ltd., Corunna	Tel. (519) 332-0220	Shell Canada Ltd., Corunna.	Tel. (519) 862-1491	Sunchem, Division of Sunoco Inc., Sarnia.	Tel. (519) 337-2301	Texaco Canada Ltd., Mississauga.	Tel. (416) 278-5511
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Texaco Canada Ltd., Mississauga.	Tel. (416) 278-5511										
NOTES											

TOLUENE-2,4-DIISOCYANATE

Colourless to light yellow with sharp, sweet fruity odour



SYNONYMS

TDI, Hylene T, Mondur TDS, Nacconate 100

UN No.2078

HEALTH HAZARDS

Highly toxic by ingestion and inhalation.
Vapours cause serious lung damage.
Toxicity group I, IDLH = 10 ppm, TLV = 0.02 ppm
Odour threshold = 0.4 to 2.14 ppm
Liquid
Poisonous if swallowed.
Will burn skin and eyes.

FIRE HAZARDS

Combustible.
Poisonous gas is produced in fire.

REACTIVITY

Sinks and reacts with water to form carbon dioxide and an organic base - non-violent reaction.
No reaction with other common materials.

MONITORING METHODS

1. Colorimetric detector tube for toluene diisocyanate, e.g. Drager (0.14 to 1.4 mg/m³).
2. TAGA: detection limit is < 1 in 10⁶, (< 1 ppm).
3. Adsorption on Tenax, with hexane and analysis by a gas chromatograph equipped with a flame ionization flame detector. Detection limit is 0.004 ppm by volume. See method no. 50 (AMP - 110).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including goggles).

FIRST AID

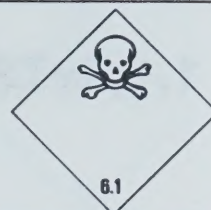
CALL FOR MEDICAL AID
Contact
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
If swallowed and victim is conscious, drink water (3 glasses).
INDUCE vomiting. Repeat 3 times.

TOLUENE-2,4-DIISOCYANATE

PHYSICAL PROPERTIES	S.G. 1.22 (25°C) B.P. 250°C V.P. ≈ 0.04 mm V.D. 6.0 F.Pt. 132° (OC) Sol. low
MANUFAC- TURERS	Not manufactured in Ontario. Allied Chemical Canada Limited, Montreal. Tel. (514) 687-9210
NOTES	

1,1,1-TRICHLOROETHANE

Colourless, watery liquid with a sweet odour



SYNONYMS

Methyl chloroform, Trichloroethane

UN No. 2831

HEALTH HAZARDS

Can be absorbed by skin. Narcotic in high concentrations.

Toxicity group II, IDLH = 1,000 ppm, TLV = 350 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes dizziness or difficult breathing.

Odour threshold = 400 ppm

Liquid

Irritating to skin and eyes.

If swallowed, may produce nausea.

FIRE HAZARDS

Combustible.

Toxic and irritating gases of chlorides produced in fire.

REACTIVITY

Sinks in water, reacting slowly and releasing corrosive hydrochloric acid. Produces an irritating vapour.

Corrodes aluminum - not hazardous.

MONITORING METHODS

1. Colorimetric detector tube for trichloroethane, e.g. Drager (50 to 600 ppm).

Interferents: Trichloroethylene is indicated with approximately the same sensitivity as

1, 1, 1 - trichloroethane. A lower sensitivity (about half) is found with tetrachloroethylene.

2. Adsorption on charcoal, desorption with carbon disulfide and analysis by gas chromatography with flame ionization detection or electron capture detection. The nominal detection limit is 0.05 mg/sample for a minimum sample volume of 0.5-litres and maximum sample volume of 13-litres. See method no. 14 (P & CAM 127).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear chemical protective suit, self-contained breathing apparatus goggles and rubber gloves.

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink water;

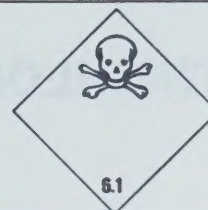
INDUCE vomiting.

1,1,1-TRICHLOROETHANE

PHYSICAL PROPERTIES	S.G. 1.32 B.P. 74°C V.P. 100 mm V.D. 4.63 F.Pt. not flammable Sol. 0.44 g/100 ml
MANUFAC- TURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519) 339-3131
NOTES	

TRICHLOROETHYLENE

Colourless, watery liquid with a sweet odour



SYNONYMS

Ethylene trichloride, Trichloroethene, Triclene

UN No. 1710

HEALTH HAZARDS

Highly toxic by inhalation.
Moderately toxic by ingestion and skin absorption.
Toxicity group II, IDLH = 1,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.
If inhaled causes nausea, vomiting, difficult breathing or loss of consciousness.

Odour threshold = 50 ppm

Liquid

Irritating to skin and eyes. If swallowed causes nausea, vomiting, difficult breathing, or loss of consciousness.

FIRE HAZARDS

Combustible.
Toxic and irritating oxides of chlorides are produced in fire.

REACTIVITY

Sinks in water with no reaction.
Produces an irritating vapour.

MONITORING METHODS

1. Colorimetric detector tube for trichloroethylene, e.g. Drager (54 to 2,200 mg/m³), Gastec (11.0 to 3,070 mg/m³), MSA (137 to 3,290 mg/m³).

Interferents: Free halogen halides and readily cleaved halogenated hydrocarbons also give a positive test.

2. Adsorption on a charcoal tube, desorption with carbon disulfide and analysis by a gas chromatograph equipped with a flame ionization detector or electron capture detector. A column packed with 10% OV - 101 stationary phase on 100/120 mesh Supel coport. The range of measurement is 579 to 2,176 mg/m³ for a 3-litre sample. See method no. 14 (NIOSH S336).

SAFETY MEASURES

Avoid contact with liquid and vapour.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with water and soap.

If swallowed and victim is conscious, drink water;

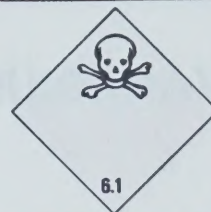
INDUCE vomiting.

TRICHLOROETHYLENE

PHYSICAL PROPERTIES	S.G. 1.46 B.P. 87°C V.P. 58 mm V.D. 4.54 F.Pt. 32°C (CC) Sol. 0.0001 g/100 ml (25°C)
MANUFAC- TURERS	Caledon Laboratories Ltd., Georgetown. Tel. (416)877-0101
NOTES	

VANADIUM PENTOXIDE

Yellowish to brown solid with no odour



SYNONYMS

Vanadic anhydride, Vanadium pentaoxide

UN No. 2862

HEALTH HAZARDS

Highly toxic by inhalation.

Toxicity group I, IDLH = 70 mg/m³, TLV = 0.5 mg/m³

Dust

Irritating to eyes, nose and throat.

If inhaled, causes coughing or difficult breathing.

Odour threshold not pertinent.

Solid

Irritating to skin and eyes.

If swallowed, causes nausea.

FIRE HAZARDS

Not flammable.

Will increase the intensity of a fire, when in contact with combustible materials.

REACTIVITY

Sinks in water with no reaction.

MONITORING METHODS

1. Collection on mixed cellulose ester membrane filter, extraction in 0.01N sodium hydroxide solution. Analysis by flameless atomic absorption (graphite furnace) with a deuterium background corrector. The range is 0.060 to 0.29 mg/m³ using a 25-litre sample. See method no. 51 (NIOSH S388).

SAFETY MEASURES

Avoid contact with solid and dust.

Wear goggles, approved dust respirator and rubber overclothing (including gloves).

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes with water and wash skin with plenty of water and soap.

If swallowed and victim is conscious, drink water, INDUCE vomiting.

VANADIUM PENTOXIDE

PHYSICAL PROPERTIES	S.G. 3.36 B.P. decomposes at 1750°C V.P. ≈ 0 mm V.D. not pertinent F.Pt. not flammable Sol. 0.8 g/100 ml
MANUFAC- TURERS	Not manufactured in Ontario. Union Carbide of Canada Ltd., Metals Division, Beauharnois, Que. Tel. (514)429-3531
NOTES	

VINYL ACETATE

Colourless, watery liquid with a pleasant fruity odour



SYNONYMS

Vinyl A monomer, VyAc, VAM

UN No. 1301

HEALTH HAZARDS

Vapour is narcotic in high concentrations.

Toxicity group I, TLV = 10 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled causes dizziness or difficult breathing.

Odour threshold = 0.12 ppm

Liquid

Irritating to eyes and skin.

Harmful if swallowed or spilled on skin.

FIRE HAZARDS

Flammable.

Containers may explode in fire.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Vapour is heavier than air.

REACTIVITY

Floats on water with slight solubility - no reaction.

Produces a flammable irritating vapour. Polymerization may occur when heated in fire, rupturing container.

MONITORING METHODS

1. Adsorption on chromosorb 107, thermal desorption and analysis by gas chromatography with flame ionization detection. A column (20 ft. x 1/8 in. o.d.) made of salinized stainless steel and packed with 10% FFAP on 80/100 mesh chromosorb W-AW is used. The range is 8 to 210 mg/m³ in 1.5-litres of air. See method no. 52 (P & CAM 278).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, drink warm water,

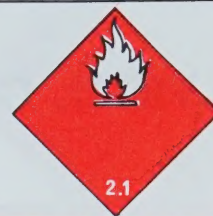
INDUCE vomiting.

VINYL ACETATE

PHYSICAL PROPERTIES	S.G. 0.93 B.P. 73°C V.P. 100 mm (22°C) V.D. -3 F.Pt. -8°C (CC) Sol. 2.5 g/100 ml
MANUFAC- TURERS	Not manufactured in Ontario. Celanese Canada Inc., Edmonton, Alta. Tel. (403)477-0546
NOTES	

VINYL CHLORIDE

Colourless, liquefied compressed gas with sweet odour



SYNONYMS

Chloroethene, Chloroethylene, VCL, VCM,
Vinyl C Monomer

UN No.1086

HEALTH HAZARDS

In high concentrations acts as an anesthetic.

Toxicity group I, TLV = 5 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes dizziness or difficult breathing.

Odour threshold = 260 ppm

Liquid

Causes frostbite.

FIRE HAZARDS

Flammable.

Flashback along vapour trail may occur.

May explode if in an enclosed area.

Toxic gases of hydrogen chloride, phosgene and carbon monoxide produced in fire. Vapour is heavier than air.

REACTIVITY

Liquid floats and boils on water with no reaction. Produces a flammable, irritating visible vapour cloud. Polymerizes in presence of air, sunlight or heat (without inhibitors).

MONITORING METHODS

1. Colorimetric detector tube for vinyl chloride, e.g. Drager (1.3 to 130 mg/m³), Gastec (0.65 to 5,200 mg/m³), MSA (1.3 to 260 mg/m³).

Interferents: Other compounds with a carbon-carbon double bond (e.g. ethylene, propylene, butadiene, perchloroethylene) are also indicated.

2. Colorimetric detector tubes for carbonyl chloride, hydrogen chloride, and carbon monoxide may also be used.
3. A known volume of air is drawn through two small sorbent tubes in series containing activated carbon. The collected vinyl chloride is then desorbed with carbon disulphide and analyzed by gas chromatograph with a flame ionization detector. The range of measurement is 0.008 to 5.2 mg/m³ in a 5-litre air sample. See method no. 53 (P & CAM 178).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

DO NOT rub affected areas.

If swallowed and conscious, drink warm water; INDUCE vomiting.

VINYL CHLORIDE

PHYSICAL PROPERTIES	S.G. 0.97 for liquid (-13°C) B.P. -14°C V.P. 2,300 mm V.D. 2.2 F.Pt. -79°C (OC) Sol. 0.6 g/100 ml
MANUFACTURERS	Dow Chemical of Canada Ltd., Sarnia. Tel. (519)339-3131
NOTES	

XYLENE

Colourless, watery liquid with a sweet odour



SYNONYMS

o-, p-, m-Xylol, 1,2-, 1,3-, 1,4-Dimethylbenzene

UN No.1307

HEALTH HAZARDS

Toxic. Vapours are anesthetic in high concentrations.

Toxicity group III, IDLH = 10,000 ppm, TLV = 100 ppm

Vapour

Irritating to eyes, nose and throat.

If inhaled, causes headache, difficult breathing or loss of consciousness.

Odour threshold = 0.05 ppm

Liquid

Irritating to skin and eyes.

If swallowed, causes nausea, vomiting or loss of consciousness.

FIRE HAZARDS

Flammable.

Flashback along vapour trail may occur.

Vapour may explode if ignited in an enclosed area.

Vapour is heavier than air.

REACTIVITY

Floats on water with no reaction.

Produces a flammable, irritating vapour.

MONITORING METHODS

1. Colorimetric detector tube for xylene, e.g. Drager (110 to 8,250 mg/m³), Gastec (44 to 2,200 mg/m³), MSA (44 to 3,550 mg/m³).

Interferents: Aliphatic hydrocarbons (e.g. heptane, octane) also give a positive test.

2. Adsorption on charcoal, desorption with carbon disulfide and analysis by a gas chromatograph equipped with a flame ionization detector. A column (3 ft. x 1/8 in. o.d. stainless steel) packed with 50/80 mesh Porapak, type Q is used. The range of measurement is 218 to 870 mg/m³ using a 12-litre sample. See method no. 14 (NIOSH no. S318 or P & CAM 127).

SAFETY MEASURES

Avoid contact with liquid and vapour.

Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).

Stay upwind.

FIRST AID

CALL FOR MEDICAL AID.

Inhalation

Move to fresh air.

If breathing has stopped, give artificial respiration; if laboured, give oxygen.

Contact

Remove contaminated clothing and shoes.

Flush eyes and skin with plenty of water.

If swallowed and victim is conscious, give mineral oil, then drink water; DO NOT induce vomiting.

XYLENE

PHYSICAL PROPERTIES	S.G. 0.86 to 0.87 B.P. 132 to 144°C V.P. < 10 mm V.D. 3.7 F.Pt. 17 to 29°C (CC) Sol. 0.02 g/100 ml
MANUFACTURERS	Domtar Chemicals Group, CDC Division, Hamilton. Tel. (416) 544-2891 Esso Chemical Canada, Sarnia. Tel. (519) 339-2000 Petrosar Ltd., Corunna. Tel. (519) 337-8251 Shell Canada Ltd., Corunna. Tel. (519) 862-1491 Sunchem, Division of Sunoco Inc., Sarnia. Tel. (519) 337-2301 Texaco Canada Ltd., Mississauga. Tel. (416) 278-5511
NOTES	

6. OTHER INFORMATION SOURCES

The principal organizations offering a dial-up technical assistance service are listed below:

- a) CANUTEC (Transport Canada Information and Emergency Centre)
(613) 996-6666

CANUTEC provides information on a 24-hour basis on how to handle a fire, spill or leak in accidents involving dangerous goods.

- b) National Environmental Emergency Centre (Environment Canada)
(819) 997-3742

The National Environmental Emergency Centre in Ottawa provides advice on the handling of hazardous material spills with particular emphasis on environmental protection. A duty officer is available on standby during working hours. The Ontario Regional office provides a similar, but less extensive service: (416) 966-5840.

- c) CHEMTREC (Chemical Manufacturers Association)
(800) 424-9300

(202) 483-7676

CHEMTREC serves as a central clearing house to which spillers can call and get immediate warnings and special advice on several thousand chemicals. It is operated by the U.S. Chemical Manufacturers Association in Washington, D.C. and can be accessed 24-hours a day either directly or via CANUTEC.

- d) OHM-TADS (Oil and Hazardous Materials Technical Assistance Data System)

OHM-TADS is a computerized data retrieval system which provides a variety of response information for approximately 1,000 chemicals. It can be accessed through Air Resources Branch office of the Ministry of the Environment: (416) 965-4081.

6. OTHER INFORMATION SOURCES

The principal organizations offering a dial-up technical assistance service are listed below:

a) COMETEC (Transport Canada Information and Emergency Centre)

(416) 952-1414

COMETEC provides information on a 24-hour basis on how to handle a fire, spill or leak in situations involving hazardous goods.

b) National Environmental Emergency Centre (Environment Canada)

(819) 397-3142

The National Environmental Emergency Centre is often providing advice on the handling of hazardous material spills with particular emphasis on environmental protection. A duty officer is available on standby during working hours. The Ontario National Office provides a similar, but less extensive service. (416) 593-5900.

c) CHEMTEC (Chemical Manufacturers Association)

(800) 424-9382

(416) 462-0772

CHEMTEC serves as a central clearing house to which spillers can call and get immediate response and special advice on several chemical spills. It is operated by the U.S. Chemical Manufacturers Association in Washington, D.C. and can be accessed through a toll-free number or via CHEMTEC.

d) 1-800-285-6011 and Hazardous Materials Technical Assistance Unit

(416) 593-5900

1-800-285-6011 is a toll-free number which provides a variety of technical assistance for approximately 1,000 chemicals. It can be accessed through a toll-free number. Office of the Ministry of the Environment. (416) 593-5900.

7. EXPOSURE PROTECTION

7.1 BREATHING EQUIPMENT

For response personnel, inhalation of toxicants is the primary hazard at a spill site. Since numerous chemicals are extremely toxic when inhaled, breathing equipment, appropriate for the type or class of chemicals used, must be readily available, properly maintained, and precisely fitted, and should be worn as long as an inhalation hazard is suspected.

Respiratory devices are of two types: oxygen or air supply and air-purifying. The former includes:

- Self-contained breathing apparatus (SCBA)

SCBA provides a pure air mixture from a source carried by the user and is independent of the surrounding environment. Recirculating respirators, using a pure oxygen atmosphere, are not recommended at a spill site due to the extreme reactivity of oxygen in high concentrations. Compressed air respirators are recommended whenever they are available.

- The hose-type respirator

This device provides pure air that is pumped from a source outside the contaminated environment.

In air-purifying respirators, gaseous contaminants are removed from otherwise respirable air by absorption, adsorption, and chemical reaction. Particulates are removed by mechanical filtration. Air purifying respirators cannot be used in oxygen deficient atmospheres and must not be used where vapour concentrations are higher than those for which the respirators were designed. Their usefulness is restricted to the gas (or gases) and/or particulates for which they are designed. They are designed for short-term ($\frac{1}{2}$ hour) use and generally afford no protection from vapour concentrations above 2 per cent. Air purifying respirators are of three types:

- Chemical respirators

Inspired air is drawn over a chemical or through a cartridge containing suitable chemicals to remove gases or vapours. These respirators and interchangeable cartridges are usually specifically designed for a particular type of class of gas or vapour.

- Mechanical filters

These are similar to chemical cartridge respirators except that the purifying chemicals in the cartridge are replaced by filters. Filter respirators are designed to remove a single particulate contaminant or class of particulates. Certain substances, such as mercury, have such high vapour pressures that inspired air passing over them may introduce toxic vapours into the air being breathed. Combination chemo-mechanical, air-supplied respirators, or SCBA are required in these cases.

- Combination respirators for gases and particulates

These respirators provide simultaneous protection against gases, vapours, and particulates. They consist of gas-mask canister or chemical cartridges with mechanical filters in series.

Maximal protection is obtained by a SCBA with a fitted full-face mask. At any spill site, an unknown chemical should be regarded as highly hazardous and SCBA should be employed. Neither self-contained breathing apparatus nor purifying respirators will provide protection unless they are properly fitted to the individual user and maintained in proper working order. They need to be cleaned after each use and chemical cartridges or mechanical filters should be replaced. In any case, respirators employed should be approved by the National Institute of Occupational Safety and Health.

The type and degree of hazard to be encountered will govern the kind of respiratory device to be used. The following classification of atmospheres may be used to determine the respirator to be used:

- Oxygen deficiency: SCBA

Air normally contains 21 per cent oxygen by volume. This may be reduced by dilution, displacement, or removal of oxygen by other gases, chemical reaction, or absorption in certain materials.

Atmospheres with 16 per cent or less oxygen may cause serious injury or death, depending on the actual concentration, length of exposure and physical activity. In oxygen-deficient atmospheres, a self-contained breathing apparatus is required.

- Gases and vapours and some fumes: SCBA or chemical cartridge

Gases and vapours may be classified as toxic or inert. Inert gases are dangerous when they displace oxygen from the air. This would necessitate the use of self-contained breathing apparatus. Toxic gases require the use of chemical respirators or SCBA.

- Particulates: SCBA or mechanical filter

Particulates are dispersions of solids (dust, smoke, or fumes) or liquids (mists or fogs) or combinations of the two. Aerosols are dispersions of very fine solid or liquid particles in air. With rare exceptions, such as in the presence of organic phosphorus pesticides, massive concentrations of highly toxic metals, or rapidly sublimable fumes, mechanical filtration will provide sufficient protection for short exposure periods.

- Combination of particulates and gases and some fumes: SCBA or combinations of chemical cartridge and mechanical filter

Special respiratory devices are available for protection against more than one type of contaminant. These combine chemical canisters and mechanical filters to eliminate both gases and particulates. Special respiratory devices should be selected and their limitations carefully noted to provide protection against the maximum expected concentrations of each contaminant.

7.2 SKIN CONTACT

The skin, and its associated film of lipid and sweat, is normally an effective barrier for protection of underlying body tissues. Relatively few substances are absorbed through this barrier in dangerous amounts. Organic solvents can remove the lipid film and gain entrance through the skin, hair follicles, or sebaceous glands. Indeed, such solvents may act as carriers for other chemicals that would not normally penetrate the skin. This mechanism can be an important one if solvents are spilled on skin surfaces or clothing or during the too-frequently routine ritual of washing oily or greasy hands in organic solvent baths. Several of the chlorinated solvents, e.g., trichloroethane, are handled far too casually considering their own toxicity as well as their potential as carriers for other substances.

Keep in mind that the effectiveness of the skin as a barrier depends upon its unit integrity. Breaks in that integrity, in the form of open wounds and bodily orifices greatly reduce the barrier effectiveness. Absorption through and/or attack of mucous membranes is quite rapid for many chemicals. Eye protection therefore serves a two-fold purpose - safeguarding the sensitive tissues of the eye and removing a potential site for systemic absorption.

In addition to absorption through the skin, direct irritation and sensitization of skin layers per se can occur. Caustics and acids represent the most common skin contact irritants. Severe burns can result with associated disfigurement, disability, and susceptibility to secondary infection. Note that while acids tend to cause conjugation of skin proteins, reinforcing the barrier to further penetration, alkalis do not, and can penetrate to cause deeper tissue destruction. In powdered form, such materials may react with skin moisture to cause localized irritation or more severe burns. Appropriate protective clothing, gloves, and eye covering are indicated when contact with reactive materials is possible.

The reaction of some chemicals with protein in the skin layers causes sensitization. Subsequent exposure is likely to give rise to a contact dermatitis, i.e., skin rash with associated itching, burning, cracking, and the possibility of secondary infection. Allergic reactions can also result in increased vascular permeability, with development of "water blisters", or edema. Such swellings may cause a severe obstruction to swallow, breathing, or vision.

There are creams, gels, and greases available which function as a protective barrier and offer limited protection to skin surfaces. The protection is generally rather short-lived in a working environment, but where necessity for dexterous manipulation precludes the use of protective gloves, such barrier materials may be indicated to provide short-term protection. The silicone greases appear to be among the most effective of these and are even resistant to penetration by a range of organic solvents. The worker should know the limitations of barrier materials including their potential reactivity with spilled chemicals and the likelihood of maintaining barrier integrity in a given work situation.

7.3 EYE PROTECTION

Eye protection must not be overlooked while on the spill site. As with inhalation, damage may be irreversible within a matter of seconds.

Contact lenses should not be worn on the spill site since they serve to concentrate materials which enter the eye.

A major problem in providing eye protection comes from corrosive fumes or vapour which directly attack eye tissues. Many goggles, although safety-approved, have vents and dust screens to allow for air flow. It is apparent that if corrosive fumes are present, goggles without such ventilation are necessary. Under such conditions, a self-contained breathing apparatus of the type described earlier would normally be necessary and should provide proper protection.

In discharges where the material is not capable of producing corrosive vapours or fumes, dust-type goggles are considered satisfactory providing they are equipped with filters to remove any particles which may enter through the vented regions.

7.4 INGESTION

Poisoning by ingestion, i.e., absorption from the gastrointestinal tract, is far less common than inhalation or skin contact in a spill response situation. This is partly the result of a strong human aversion to swallowing foreign substances and the voluntary aspects of ingestion. However, poisoning by this route can occur without the knowledge of the worker through contamination of temporary drinking water supplies or foodstuffs, failure to wash hands before eating, or swallowing inhaled toxic particles entrapped in sputum. Awareness of the potential toxicity of the materials being dealt with and common-sense practice will minimize the chances of intoxication by this route.

8. COMPLICATING CONDITIONS AT SPILL SITE

8.1 GENERAL

The hazards presented by spilled materials may be either intensified or ameliorated by local conditions at the spill site. Weather conditions, wreckage, litter, fire (actual or potential), or other conditions may require modification of basic spill monitoring approaches. Such factors may superimpose additional restrictions on monitoring and clean-up operations by affecting the nature and rate of movement of materials within and beyond the immediate spill area, the toxicity and reactivity of spilled substances, and the monitor's mobility within the working area.

8.2 WEATHER

Wind increases the dispersal of toxic gases, powders, and aerosols from the spill site. Restriction of public access to affected downwind areas should be considered. If possible, monitors should approach the spill site from upwind to avoid unnecessary exposure to a hazardous substance; this is especially important if there is a potential for ignition. Be aware at all times that winds can shift and that personnel can be subjected to additional hazard under such conditions. Wind action greatly increases the hazards where fire complicates a monitoring or clean-up operation, but can be beneficial as it reduces the possibility of explosive fume build-ups. On water, winds increase wave activity and may require approach to a spill site, e.g. a damaged barge, from downwind, to avoid possible collision. The special conditions of such an approach should be carefully evaluated with an eye toward minimizing personnel safety hazards.

Precipitation is often a mixed blessing at a hazardous materials spill site. On the positive side, it can dilute toxic material concentrations, cool potential reactants, and suppress the aerial dispersal of powders and aerosols. On the other hand, rain increases sheet runoff and water-

borne dispersal; causes spread of many materials, including combustible liquids; causes slippery working conditions; and may react with alkali metals, anhydrous powders, concentrated acids, some organics, etc., to yield heat, fire, spattering, gases, or toxic fumes.

High ambient temperatures increase volatilization and chemical reaction rates. The likelihood of explosive gas concentrations and toxic reaction products increases with increasing temperature. High temperatures also increase the personnel fatigue factor and, therefore, the possibilities of potentially dangerous judgement errors. As judgement and common sense are the worker's primary safeguards, on-site supervisors and working-level personnel should recognize the signs of fatigue and remove themselves to rest areas for recuperation.

8.3 FIRE

Fire or high fire potential at a spill site represents a very special working environment for spill monitors. In general, to cope with these hazards, on-site personnel either should have training in appropriate techniques for prevention and control of fires, or should leave the job to specialized units who have the proper training and equipment.

Chemical reactivity and the potential for toxic products is greatly enhanced under fire conditions. Monitors should coordinate closely with fire safety personnel to identify and prioritize the potential hazards to spill-site personnel and the public.

The convective air currents formed by fires can carry toxic products far from the spill site. Restricting access to downwind areas should be considered as well as monitoring the nature, concentration, and extent of such transport.

8.4 WRECKAGE LITTER

Especially where spills result from wrecks of transport vehicles or explosions at manufacturing, processing, or packaging installations, monitors may find themselves working around torn and twisted structural materials. Care should be exercised to avoid cutting or tearing protective clothing or snagging breathing apparatus on such site debris. When working with toxic substances a laceration or puncture can be a serious route to systemic poisoning. Fume and fire hazard potential should be evaluated prior to any torch cutting.

8.5 MISCELLANEOUS

Other hazards may also exist. Downed power lines present a shock danger and add to the probability of fire and explosion. Broken steam lines, in addition to posing a burn hazard, may also reduce visibility and contribute substantial amounts of uncontrolled water at the scene. Disturbed wildlife may be present and, due to the stresses imposed, be atypically aggressive. (If bitten, attempt to kill or capture the animal for rabies tests, identify snake species for anti-toxin selection, etc.) High speed traffic, extreme cold, radioactive materials, deep swift water, etc., will present different, but significant dangers. It is impossible to foresee all possible hazards at a spill site. Again, alertness, the use of common sense and good judgement will help to avoid most of these dangers.

9. FIRST AID

9.1 GENERAL

First aid is generally defined as the immediate and temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained. Common sense and a few simple rules are the keys to effective first aid.

The first objective is to save life by:

- . Ensuring an open airway and maintaining breathing.
- . Preventing heavy loss of blood.
- . Giving first aid for poisoning.
- . Preventing or reducing shock.
- . Preventing further injury.
- . Sending for medical aid.

The first-aider should also:

- . Avoid panic.
- . Inspire confidence.
- . Do no more than necessary until professional help arrives.

9.2 HEAVY BLEEDING

A victim who has profuse bleeding may die within one minute or less, therefore:

- . DO NOT WASTE TIME.
- . USE PRESSURE DIRECTLY OVER THE WOUND.

- . Place a pad, clean handkerchief, clean cloth, etc., directly over the wound and press firmly with one or both of your hands. If a pad or bandage is not available, close the wound with your hand or fingers.
- . Hold the pad firmly in place with a strong bandage, necktie, strips of cloth, etc. Unless bones are broken, raise the bleeding part higher than the rest of the body.
- . Keep the victim warm to prevent loss of body heat. Cover with blankets, coat, or anything available and put something under him if he is on a cold or damp surface. Do not add heat.
- . Give fluids only if victim does not have head or abdominal injuries, probably will not require surgery, and professional help will be more than one hour arriving. If the victim is conscious and can swallow, give him plenty of liquids to drink. Give him sips and do not give stimulants.
- . Call a physician.
- . Use a tourniquet only if victim is bleeding profusely and other methods have failed and the victim's life is in danger.
- . DO NOT give the victim alcoholic drinks.
- . If the victim is UNCONSCIOUS or if abdominal injury is suspected, DO NOT give him fluids.

9.3 BREATHING STOPPED

A person who has stopped breathing will die if breathing is not restored immediately.

If breathing is restored, victims who had stopped breathing need hospitalization.

The following are major factors in breathing stoppage:

- Poisonous gases in the air or lack of oxygen

- . Move victim to fresh air.
- . Begin mouth-to-mouth breathing.
- . Control the source of poisonous gases, if possible.
- . Keep others away from area.
- . DO NOT enter an enclosed area to rescue an unconscious victim without first being equipped with a self-contained or air-supplied breathing apparatus.

- Electric shock

- . If electrical hazard persists: Indoors, open main electrical breaker if appropriate individual breaker cannot be immediately identified; outdoors, contact power company to turn current off.
- . DO NOT TOUCH the victim until he is separated from the current.
- . Begin mouth-to-mouth resuscitation or cardiopulmonary resuscitation, if needed and if trained in this technique, as soon as the victim is free of contact with the current.
- . DO NOT try to remove a person from an out-of-doors wire unless you have had special training for this type of rescue work.

- Heart attack

- Laryngeal obstruction

- Accident or drowning

When breathing movements stop or lips, tongue, and fingernails become blue, there is need for help with breathing.

When in doubt, begin artificial respiration. No harm can result from its use. Delay may cost the victim his life.

9.4 ARTIFICIAL RESPIRATION

- General

- . Seconds count. Start immediately.
- . Remove any obvious obstruction from mouth and throat.
- . Place victim in appropriate position and begin artificial respiration.
- . Maintain steady rhythm of 12 breaths per minute.
- . Maintain an open airway and periodically check the victim. Be ready to resume artificial respiration if necessary.
- . Call a physician.
- . DO NOT move the victim unless absolutely necessary to remove from danger.
- . DO NOT wait or look for help.
- . DO NOT stop to loosen clothing or warm the victim.
- . DO NOT give up.

- Mouth-to-mouth breathing for adults

- . Place victim in supine position (on back).
- . Tilt victim's head back by pressing on his forehead with your other hand.

- . Place your cheek and ear over the victim's nose and mouth, looking at his chest. Look, listen and feel for breathing for about 5 seconds.
- . Pinch the victim's nose shut with the thumb and forefinger of the hand on victim's forehead. Take a deep breath and place your mouth over the victim's mouth or nose making a leak-proof seal.
- . Blow your breath into the victim's mouth or nose until you see the chest rise; repeat these breaths 4 times in rapid succession without allowing the lungs to fully deflate between breaths.
- . Maintain the head tilt and again check the victim for breathing for approximately 5 seconds.
- . Remove your mouth and let the victim exhale while you take another deep breath. As soon as you hear the victim breathe out, replace your mouth over his mouth or nose and repeat the procedure.
- . Repeat this procedure of giving one breath, turning to look, listen and feel for return of air, and blowing again, once every five seconds (12 times per minute).

- Manual method of artificial respiration

- . Place the victim in a face-up position but allow his head to turn to the side to avoid aspiration.
- . Place something under the victim's shoulder to raise them to allow the head to drop backward.
- . Kneel above victim's head, facing the victim.
- . Grasp victim's arm at the wrists, crossing and pressing victim's wrists against the lower chest.
- . Immediately, pull arms upward, outward, and backward as far as possible.
- . Repeat 15 times per minute.

- . If a second person is present, he should hold the victim's head so that it tilts backward and the jaw juts forward.
- . This method should be used when mouth-to-mouth resuscitation is advised against.

- Cardiopulmonary resuscitation (CPR)

Heart-lung resuscitation is an emergency procedure which requires the ability to recognize a cardiac arrest and special training in its performance. All training programs should adhere to the standards put forth in JAMA "Supplement on Standards for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (EEC)". 18 February 1974, Volume 227, Number 7. *Information provided here on cardiopulmonary resuscitation is not designed to supplant a complete course of instruction under direction of a qualified instructor. Such instruction is strongly recommended for all personnel who must respond to hazardous materials spill sites.*

Emergency cardiopulmonary resuscitation involves the following steps:

- . Airway opened.
- . Breathing restored.
- . Circulation restored.

External cardiac compression should be started after providing four quick breaths and checking for pulse and breathing. If apnea (breathing stoppage) persists, and there is unconsciousness, death-like appearance and absence of carotid pulse, external cardiac compression should be started.

External cardiac compression consists of the application of rhythmic pressure over the lower half of the sternum. This compresses the heart and produces artificial circulation because the heart lies almost in the middle of the chest between the lower sternum and the spine.

External cardiac compression should always be accompanied by artificial respiration. To be effective, it requires sufficient pressure to depress the victim's lower sternum 1-1/2 to 2 inches (3.8 to 5.1 centimetres) in an adult; the rate should be once a second. Considerably less effort will be required to achieve such depression in a child. The victim should be on his back on a firm surface. The rescuer stations himself at the side of the patient and places only the heel of one hand over the lower half of the sternum. He then places his other hand on top of the first one and rocks forward so that his shoulders are almost directly above the patient's chest. Keeping the arms straight and elbows locked, he exerts adequate pressure almost vertically downward. The preferred rate of 60 per minute is usually rapid enough to maintain blood flow and slow enough to allow cardiac refill. The compressions should be regular, smooth, and uninterrupted, with compression and relaxation being of equal duration. Under no circumstances should compression be interrupted for more than 5 seconds.

When there are two rescuers, optimum ventilation and circulation are achieved by quickly interposing one inflation after five chest compressions without any pause in compressions (5:1 ratio). Every interruption in cardiac compression results in a drop of blood pressure to zero. One rescuer performs external cardiac compression while the other one keeps the patient's head tilted back and continues ventilation. When there is only one rescuer he must perform both artificial respiration and artificial circulation using a 15:2 ratio; two quick lung inflations after every 15 chest compressions. Periodic palpation of the carotid pulse should be employed to check the effectiveness of external cardiac compressions or the return of a spontaneous heartbeat.

Complications occurring from the use of cardiopulmonary resuscitation may include fracture of the ribs and sternum, laceration of the liver, and fat emboli.

Several rules to follow are:

- . Never compress over the xiphoid process, the lower tip of the sternum. It extends down over the abdomen and pressure on it may cause a dangerous laceration of the liver.
- . Never let the fingers touch the patient's ribs when compressing. Keep just the heel of the hand in the middle of the victim's chest over the lower half of his sternum.
- . Never use sudden or jerking movements to compress the chest.
- . Never compress the chest and abdomen simultaneously. This traps the liver and may cause it to rupture.

9.5 SHOCK

Severe injury or emotional upset is usually followed by shock. It can also follow infection, pain, disturbance of circulation from bleeding, stroke, heart attack, heat exhaustion, food or chemical poisoning, extensive burns, etc. The following information pertains to traumatic, injury-related shock rather than to emotional shock, per se.

- The signs of shock include:

- . Cold and clammy skin with beads of perspiration on the forehead and palms of hands.
- . Pale face, weakness, dilated pupils, and weak, rapid pulse.
- . Complaint by the victim of feeling cold, or even shaking chills.
- . Frequent nausea or vomiting.
- . Shallow breathing.

- To prevent shock:

- . If possible, correct cause of shock (e.g. control bleeding).
- . Keep victim lying down.
- . Keep the airway open. If victim is vomiting, turn his head to the side so that the neck is arched.
- . Keep victim warm if weather is cold or damp.
- . Give fluids only if victim does not have head or abdominal injuries, probably will not require surgery, and professional help will be more than one hour arriving. Give him sips and do not give stimulants. A suggested formula is one pinch baking soda and two pinches salt per glass (10 oz.) of water.
- . Reassure victim.
- . NEVER give alcoholic beverages.
- . DO NOT give fluids to unconscious or semiconscious persons.
- . PREVENTION OF SHOCK SHOULD BE CONSIDERED WITH EVERY INJURY.

9.6 POISONING

Before medical aid is available, the following should be done. SPEED IS ESSENTIAL:

- . Act before the body has time to absorb the poison.
- . When medical aid is available, give physician all possible knowledge available on the poison.

The nature of the poison will determine the first aid measure to use:

- Swallowed poisons

- . If victim is conscious, give water or milk immediately.

DO NOT INDUCE VOMITING (except on the advice of doctor or Poison Control Centre):

- . If the victim is unconscious,
- . Is in convulsions,
- . Is known to have swallowed a petroleum product (kerosene, gasoline, lighter fluid), toilet bowl cleaner, rust remover, drain cleaner, lye, acids for personal or household use, iodine, styptic pencil, washing soda, ammonia water, or household bleach, or has symptoms of severe pain, or a burning sensation in mouth or throat.

DO NOT INDUCE VOMITING if "do not induce vomiting" is indicated in the first aid segment of the chemical data sheets.

- . Information on labels may be incorrect; contact physician or Poison Control Centre immediately for proper advice.
- . Call for medical aid immediately.
- . Begin mouth-to-mouth resuscitation if the victim has difficulty breathing.
- . If safe (see above), induce vomiting.
- . Induce vomiting by use of 10 grams salt in 200 cc of warm water (2 teaspoonfuls in a glass of warm water) or use 30 cc's or one ounce of syrup of ipecac.

- . When vomiting begins, place the victim face down with head lower than hips. This prevents vomitus from entering the airways and causing further damage.

- Inhaled poisons

- . Assist or carry victim to fresh air immediately.
- . Apply artificial respiration if breathing has stopped or is irregular.
- . Call physician.
- . Treat for shock.
- . Keep victim as quiet as possible.
- . DO NOT give alcohol in any form.
- . DO NOT become a victim by exposure to the same poison.
- . Rescuer should employ appropriate protective clothing and breathing apparatus until clear of hazard.

9.7 EYES

First aid for chemicals in the eyes is the immediate washing of the eyes with large quantities of water. Hold the eyelids open and roll the eye while irrigating with water. Emphasis should be placed on the amount of water, the speed with which it is applied, and washing the eye "from the inside outward". Eyes should be washed for at least 10 minutes. A delay of 30 seconds can mean the difference between no injury to the eye and permanent loss of vision.

Chemical burns to the eyes can be aggravated by contact lenses. Chemicals spilled in the eyes tend to accumulate under contact lenses. In addition, for proper irrigation, contact lenses need to be removed. It is advisable not to wear contact lenses at a spill site.

In cases of alkaline or acid chemicals in the eyes, irrigation with neutralizing agents should not be used as first aid treatment. Acids in contact with the cornea will react with protein to form an insoluble barrier. This barrier prevents penetration of the acid into the eye. An alkaline solution does not form this barrier and is free to soak deep into the eye. If this happens with an alkaline solution and an acid neutralizing agent is used, the alkaline solution will be trapped under the insoluble barrier formed by the acid-protein reaction. This will prevent the leaching out of the alkaline solution by irrigation.

Most serious chemical injuries to eyes can be avoided by quickly and properly washing the eyes with large amounts of water.

9.8 BURNS

- General

- . Burns can result from heat (thermal burns) or from chemicals (chemical burns).
- . Shock can complicate every type of burn.
- . A person with "burn shock" may die unless he receives immediate first aid.
- . In "burn shock", the liquid part of the blood is sent by the body into the burned areas. There may not be enough blood volume left to keep the brain, heart, and other organs functioning normally.
- . All burns should be seen by a physician or nurse.

- Objectives of first aid care for burns are to:

- . Prevent and treat shock.
- . Prevent contamination.
- . Control pain.

- Extensive thermal burns

- . Place the cleanest available cloth material over all burned body areas to exclude air. Covering for burns should be a clean, thick, dry dressing. Clean newspaper can be substituted if no clean cloth is available.
- . Have the victim lie down.
- . Call physician.
- . Place victim's head and chest a little lower than the rest of the body. Elevate the legs slightly if possible.
- . If the victim is conscious and can swallow, give him plenty of non-alcoholic liquids to drink (water, tea, coffee, dilute salt solution).
- . Move to hospital immediately.

- Small thermal burns

- . If SKIN IS NOT BROKEN, immerse burned part in clean, cold water to relieve pain, reduce inflammation. Do not apply ice directly to the skin.
- . Soak a sterile gauze pad or clean cloth in baking soda solution: 2 tablespoonfuls baking soda (sodium bicarbonate) to 1 quart of lukewarm water.
- . Place pad over burn and bandage it loosely.
- . DO NOT disturb or open blisters.

- Chemical burns

- . Immediately flush with water, speed in washing is most important in reducing the extent of injury.
- . Flush affected area with plenty of water.
- . Remove all contaminated clothing and shoes.
- . Place the cleanest available material over the burned area.
- . Treat for shock.
- . If the burned area is extensive, have victim lie down.
- . Keep him down until medical aid is available.
- . Place his chest and head a little lower than the rest of the body (raise the legs slightly if possible).
- . Maintain an open airway.
- . If he is conscious and can swallow, give him plenty of non-alcoholic liquids to drink.
- . DO NOT APPLY OINTMENTS, greases, baking soda, or other substances to extensive burns.

9.9 ENVIRONMENTAL TEMPERATURE EXTREMES

- Heat exhaustion

SYMPTOMS:

- . Pale and clammy skin.
- . Pulse rapid and weak.

- . Victim complains of weakness, headache, or nausea.

- . Victim may have cramps in abdomen or limbs.

FIRST AID:

- . Have victim lie down with his head level with or lower than his body.

- . Move victim to a cool place, but protect him from chilling.

- . Give the victim salt water (1 teaspoonful salt to 1 quart water) to drink if he is conscious.

- . Loosen tight clothing.

- . Call for medical aid.

- Heat stroke

SYMPTOMS:

- . Flushed and hot skin.

- . Pulse rapid and strong.

- . Victim often is unconscious.

FIRST AID:

- . Call for medical aid.

- . Cool body by sponging it with cold water or by cold applications.

- . If the victim is fully conscious and can swallow, give him salt water (1 teaspoonful salt to 1 quart water).
- . DO NOT give alcohol in any form.

- Frostbite

SYMPTOMS:

- . Skin color changes to white or greyish-yellow as frostbite develops.
- . Initial pain which quickly subsides.
- . Victim feels cold and numb; he usually is not aware of frostbite.

FIRST AID:

- . Cover the frostbitten part with a warm hand or woollen material.
- . If fingers or hand are frostbitten, have victim hold his hand in his armpit, next to his body.
- . Bring victim inside as soon as possible.
- . Place frostbitten part in warm water, about 42°C. (108°F.)
- . Gently wrap the part in blankets if warm water is not available or is impractical to use.
- . Let circulation reestablish itself naturally.
- . When the part is warmed, encourage the victim to exercise fingers and toes.

. Give victim a warm, sweet, non-alcoholic drink.

. DO NOT RUB with snow or ice. DO NOT USE HOT WATER, hot water bottles, or heat lamps over the frostbitten area.

9.10 MOVING THE INJURED

- General

Do not move an injured person until an experienced crew arrives, unless there is real danger of his receiving further injury by remaining at accident site.

Control bleeding if possible, maintain breathing, and immobilize all suspected fracture sites before moving.

Treat for shock.

- Pulling the victim to safety

Pull the victim head first or feet first, not sideways.

BE SURE HEAD IS PROTECTED.

- Lifting the victim to safety

If he must be lifted before a check for injuries can be made, every part of the body should be supported. The body should be kept in a straight line and should not be bent. Once victim is lifted, the lifter is responsible for the victim's safe return to the ground/floor.

Exercise care in the approach of any "downed" co-worker or bystander victim. Rapid action may be called for, but hasty and careless intervention may lead to additional injury or loss of life, avoidable if a few moments are taken to assess the immediacy and severity of the situation. Once again, the exercise of careful, informed judgement and plain common sense, is the most important safeguard of personnel health.

